CANADIAN ELECTRONICS ENGINEERING

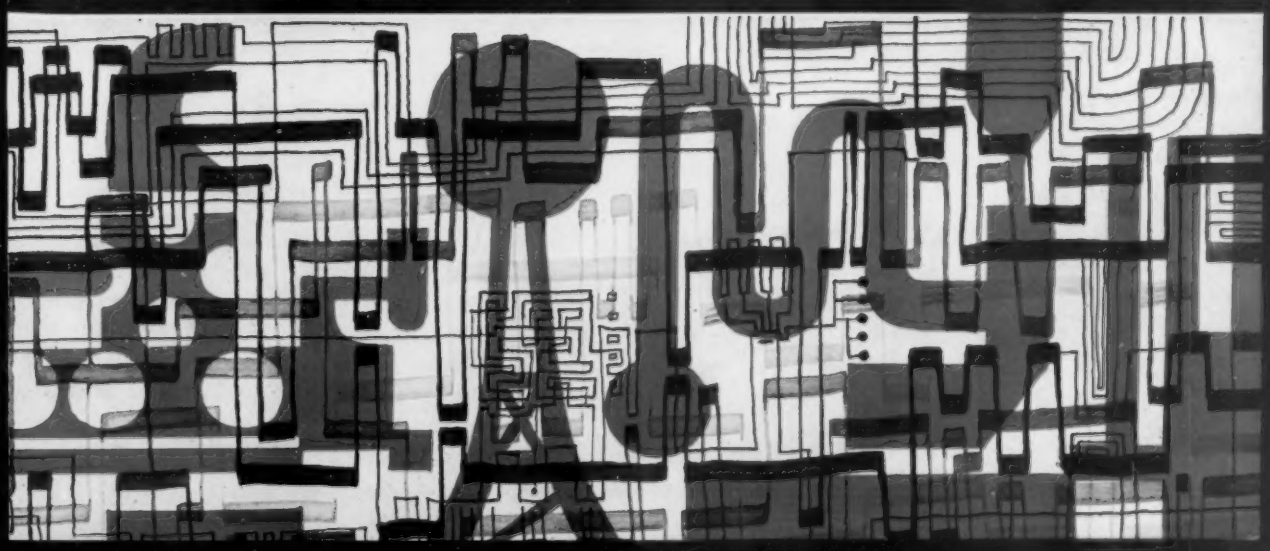
DECEMBER 1960
A Maclean-Hunter Publication
five dollars a year

Problems facing industrial electronic manufacturers in Canada

Procurement decisions must be based on sound economic studies

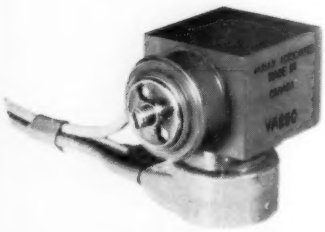
Self-adapting controls will extend industrial automation

FEATURE REPORT: Industrial Electronics problems and prospects



NUMBER **3** of a series

KLYSTRON MANUFACTURE AT VARIAN Georgetown



VA-250
REFLEX KLYSTRON

The standards of Klystron Finishing are continually being raised due to the ever increasing environmental requirements of the space age.

VARIAN Research and Process Controls are paced to meet present and future demands for altitude without pressurizing, humidity, stability at extreme temperatures, vibration and shock.

NOW FOR THE FIRST TIME A RUGGED KLYSTRON AT 70 kMc

The VA-250 is a small, lightweight Reflex Klystron Oscillator, featuring simple single screw tuning from 68.0 to 74.0 kMc. The tube is designed for airborne operation in severe environment.

Representatives: **EASTERN—R-O-R ASSOCIATES, TORONTO AND MONTREAL**
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VARIAN associates
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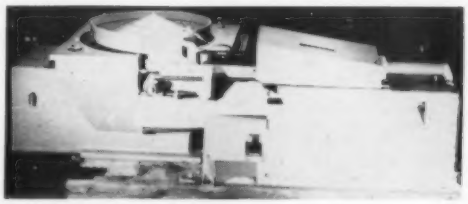
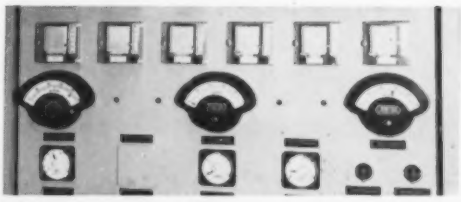
KLYSTRONS, WAVE TUBES, SWITCHING TUBES, MAGNETRONS, HIGH VACUUM EQUIPMENT, MICROWAVE SYSTEM COMPONENTS, STALOS, POWER AMPLIFIERS, GRAPHIC RECORDERS, RESEARCH AND DEVELOPMENT SERVICES

CANADIAN ELECTRONICS ENGINEERING

Volume four, number 12 December 1960

Eric W. Leaver, born in England, came to Canada 35 years ago. During the 1930's he worked on experimental television systems, 1939-41 was chief instructor at a radio school, and from 1941 to 1944 was with Research Enterprises Ltd. After a period with NRC he founded Electronic Associates Ltd. in 1946 with George R. Mounce. He is a member of APEO, IRE and CAP, and was recently elected a director of AMA.





continued on page 3

the industry's ONLY

miniaturized CAPACITOR STANDARDS

KIT #SS-32
32 standards, including every integral value from .0001 to 0.5 mfd.

- ±0.1% TOLERANCE
- 50% reduction in size
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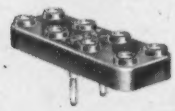
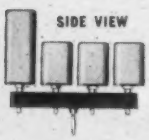
- Reduces reading errors to almost zero
- Lower in cost
- Every integral value available

Approved and now being used by the Air Force and Army in their calibration centers and laboratories. All units 100% calibrated directly against National Bureau of Standards certified primary standards.

Dimensions:
12¾w x 11½h x 4⅞d





.2639 mfd. ±0.1%

By quick and easy insertion of ARCO standard capacitors into the adapter jig, a capacitance value of four significant figures with an accuracy of ±0.1% is obtained.

SPECIFICATIONS

ACCURACY	±0.1% +0.5 mmf. of nominal printed on capacitor at 1000 cycles frequency and 23°C.
LONG TERM STABILITY	±0.05% +0.1 mmf.
INSULATION RESISTANCE	5000 megohm-microfarads or 50,000 megohms, whichever is the lesser.
DISSIPATION FACTOR	.0001 to .0004 mfd. — 0.15% .0005 to .001 mfd. — 0.1% .002 to 0.5 mfd. — 0.05%
TEMPERATURE COEFFICIENT	.0001 to .1 mfd. +40 ±15 ppm/°C; 0.2 to 0.5 mfd. −120 ±15 ppm/°C.
MAXIMUM VOLTAGE	.0001 to 0.04 mfd. 500 volts peak; 0.5 to 0.5 mfd. 300 volts peak

Individual standards also available

Write for price, delivery or additional information.

MANUFACTURERS OF:
Polystyrene capacitors, both hermetically sealed and in plastic jackets . . . multiple composition temperature controlled capacitors . . . energy storage reference units . . . precision RC networks . . . and special capacitor products.

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64 White St., New York 13, N. Y. • Branches: Dallas 7, Los Angeles 35

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Canadian Representative: LEN FINKLER LTD., 1794 Avenue Rd., Toronto 12, Ontario

For further information mark No. 14 on Readers' Service Card

CONTENTS — continued from page 1

CANADIAN ELECTRONICS ENGINEERING

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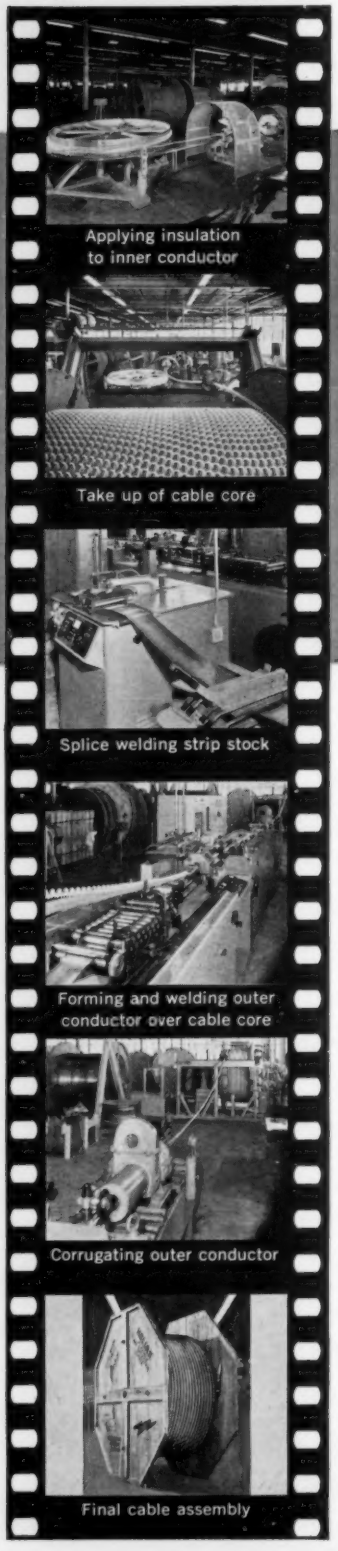
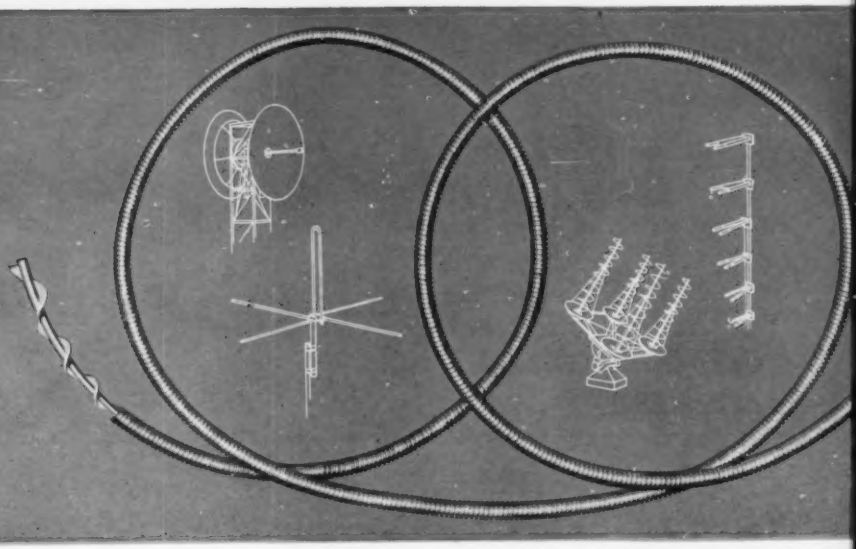
HELIAX

THE FLEXIBLE AIR DIELECTRIC CABLE

meets every communication requirement

Production scenes





Easiest to install...longest to endure

Produced in the new ANDREW plant facilities, HELIAX is the flexible, low loss, low VSWR coaxial cable for use in all applications from VLF through microwave.

The production cycle in which the copper sheet stock is formed around the cable core, welded and corrugated on a continuous basis is depicted in the film strip. Rolled sheet stock provides considerably closer tolerance tubing than is possible by extrusion or other methods.

HELIAX is the *only flexible* air dielectric cable. This flexibility is imparted by the unique, continuous helical corrugated construction. Bending torque required is about one-half that required for straight wall aluminum or copper tubing of the same size.

HELIAX has the greatest resistance to crushing or kinking. Again this is due to its unique construction. Resistance to physical damage from crushing or kinking forces is about twice that of conventional aluminum or copper cables of comparable size.

HELIAX is the only air dielectric coaxial cable capable of being manufactured in continuous lengths. Critical applications need no longer depend on splicing 1,000 feet or shorter lengths to make up a long cable run. HELIAX affords the only splice free, trouble free air dielectric cable installation.

STANDARD SIZES AND TYPE NUMBERS

SIZE	IMPEDANCE	TYPE NO.
3/8	50	H3-50
7/8	50	H5-50
7/8	75	H5-75
7/8	100	HT5-100
1 5/8	50	H7-50
1 5/8	75	H7-75
1 5/8	100	H7-100
3 1/8	50	H2-50
3 1/8	75	H2-75

ANDREW is your *only* fully integrated source capable of the design and manufacture of cable *and* fittings as well as antennas. ANDREW offers a wealth of engineering experience in the field of RF transmission devices.

You're invited to write for the new HELIAX Catalog H.

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606 BEECH ST., WHITBY, ONTARIO

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NEWS HIGHLIGHTS

GE scientist reveals discovery that yields new scientific concepts and makes new devices feasible

The electronic process known as "tunneling," which has previously proved useful in carefully prepared semiconductor materials, has been observed for the first time in devices of simpler configuration. Ivar Giaever, physicist at the General Electric Research Laboratory, Schenectady, has made this announcement based on his work with two metal films separated by a thin insulating layer, with one or both of the films in the superconducting state. It is claimed that the discovery may make possible a new family of electron devices unequalled for their versatility and small size.

Long-distance digital television transmission system developed for U. S. Army by Colorado Research Corp.

The unconventional transmission system is capable of transmitting clear TV pictures over long distances in spite of intense sunspot, lightning, aircraft, or other radio noise activities. The use of digital pulse techniques permits distortion-free amplification at repeater stations, and may facilitate the transmission of video signals from space vehicles.

Canadian business equipment finds $5-million-a-year market in Japan

International Business Machines Co. Ltd., Don Mills, Ontario, Canada's major manufacturer in this field, is enjoying an upsurge in sales to Japan that has doubled the size of its shipments and tripled their frequency in two years. Items range from electric typewriters to the medium-size "650" computer, and Japan is now estimated as IBM's second largest overseas customer.

$500,000 Ferranti-Packard electronic banking system installed at New York branch of Federal Reserve Bank

See "Controls and instrumentation" on page 48 for full story.

Inventory of TV receivers lowest in six years

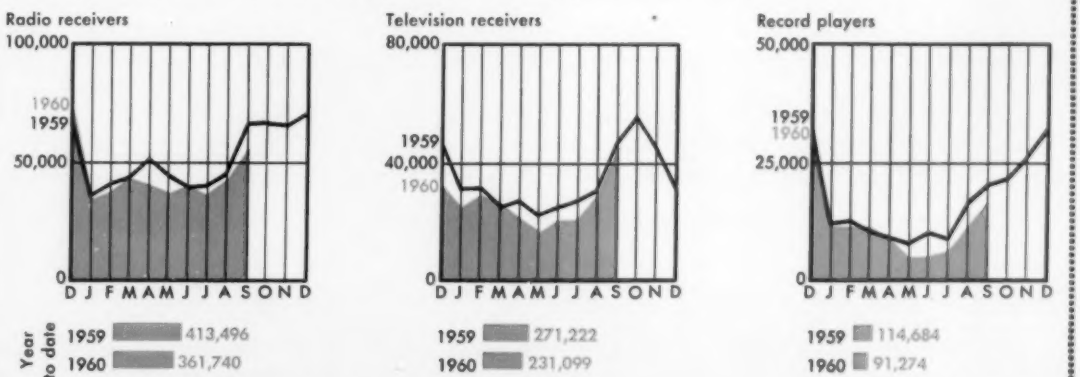
Manufacturer and distributor inventory of television receivers at September 30 was the lowest for that date since 1954, representing a reduction of 56.8% from the September 1959 inventory figure.

Resumption of all the big-name TV shows for the fall and the U. S. election telecasts have given television a much-needed boost. If sales continue to rise over the preceding month, as is customary at this time of year, and present production rates hold, this probably means only a few weeks' supply on hand.

Sales compared to the previous month continued to rise for the second month in a row in both television and radio. Radio sales improved by 32% over August to a September 1960 total of 56,270 sets. They still lag behind the 1959 total, however, by 12.5% over the nine-month period.

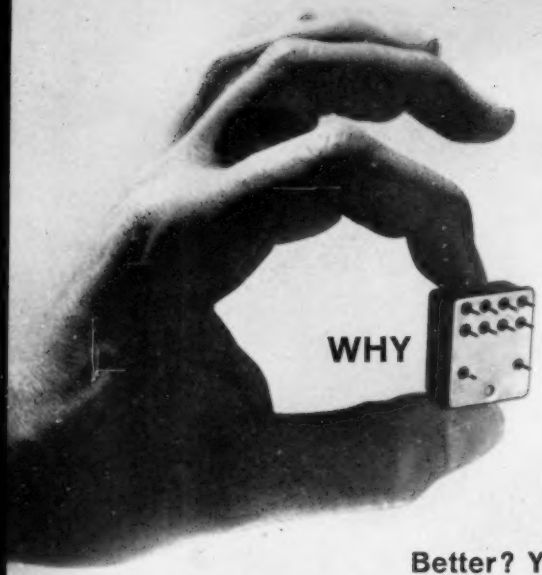
Television sales advanced again in September to a new 1960 high of 46,944 sets, an increase of 67% over August. September was also a good month for record player sales, which at 17,435 units were 34.5% over August.

However, over the nine-month period, television receiver sales were 14.8% down from 1959, and record player sales were 20.4% down.



Distributor sales to dealers, in units

Source: EIA of Canada



WHY THIS IS A BETTER *LATCHING* RELAY

Better? Yes, in several ways. Bifurcated Contacts, for example, give improved reliability, especially in dry circuits. Contacts will not open during vibrations of 30Gs, 55 to 2500 cps. A special method of sealing cover to base eliminates flux contamination of the contacts. And there are more. Here is Potter & Brumfield's newest member of a distinguished family of micro-miniature relays: the FL Series.

Expressly designed for printed circuit applications, this DPDT, 3 amperes (@ 30V DC) latching relay lies parallel to the mounting surface. Its height, when mounted, is only .485", thus circuit boards may be stacked closer. Mounting can usually be accomplished without studs or brackets, simplifying installation.

The FL will remain firmly latched in either armature position without applied power, a significant advantage where power is limited and long relay "on" times are required. This relay may be operated by:

1. Pulsing each coil alternately (observing coil polarity), or
2. Connecting the coils in series and operating from a reversing (polarized) source.

Write for complete information or call your nearest P&B representative.

FL SERIES SPECIFICATIONS

Shock: 100 Gs for 11 milliseconds. No contact openings.

Vibration: .195", no contact openings. 10 to 55 cps. 30 Gs from 55 to 2500 cps.

Pull-In: 150 milliwatts maximum (standard) at 25° C. 80 milliwatts maximum (special) at 25° C.

Operate Time: 3 milliseconds maximum at nominal voltage at 25° C.

Transfer Time: 0.5 millisecond maximum at nominal voltage at 25° C.

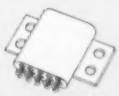
Temperature Range: −65° C to +125° C.

Terminals: Plug-in pins.

Dimensions: L. 1.100" Max.—W. .925" Max H. .485" Max. Hermetically sealed only.

SC 11 D

SCG 11 DC



SL 11 DB
(Latching)

SLG 11 DA
(Latching)

Other P&B micro-miniature relays include conventional and latching models in crystal cases with a wide range of terminals and mountings. All are made in a near-surgically clean production area under the exacting requirements of our Intensified Control and Reliability program.

P&B STANDARD RELAYS ARE AVAILABLE AT YOUR LOCAL ELECTRONIC PARTS DISTRIBUTOR

YOUR BEST SINGLE SOURCE FOR ALL MICRO-MINIATURE RELAYS

POTTER & BRUMFIELD CANADA LTD.

GUELPH. ONTARIO

Dr. L. Berkner elected president of Institute of Radio Engineers

The Institute of Radio Engineers has elected **Dr. L. V. Berkner** president for 1961 succeeding **Dr. R. L. McFarlan. Dr. Franz Ollendorff** and **John F. Byrne** have been elected vice-presidents.

Dr. Berkner is president of Associated Universities, Inc., a firm set up as an educational institution to operate such research facilities as Brookhaven National Laboratory and the National Radio Astronomy Observatory. Dr. Berkner is also chairman of the Space Science Board of the National Academy of Science.

Dr. Ollendorff, a research professor at the Technion - Israel Institute of Technology, Haifa, Israel, was elected vice-president representing overseas countries. Mr. Byrne, manager of the Riverside Research Laboratory of Motorola, Inc., was elected vice-president representing North America.

Bertram R. Tupper, chief engineer of British Columbia Telephone Co., Vancouver, has been elected director of IRE Canadian Region. He succeeds **A. P. H. Barclay.**

Collins Radio Co. of Canada forms new division

A new commercial division has been established within Collins Radio Company of Canada Ltd. to place greater sales emphasis on the Canadian commercial market of communications and aviation products. **M. Binions,** former Ottawa resident manager for Collins, has been appointed sales manager of the new division with headquarters in Toronto.

Arthur R. Hewitt, recently retired from the Royal Canadian Navy, has been appointed Ottawa resident manager, succeeding Mr. Binions. At the time of his retirement, Mr. Hewitt was Director of Supplementary Radio Activities (Commander RCN).

Marsland Engineering adds to sales staff

Marsland Engineering Ltd. has appointed **G. Given** to its sales staff for electronic components. He will be located at Kitchener, Ontario.

Vice-president appointed at Cerl-Dale Ltd.

The former director of procurement for Dale Electronics, Inc., Columbus, Nebraska, **Harry D. Smith,** has been appointed vice-president and general manager of Cerl-Dale Ltd., Toronto. Mr. Smith is a U.S. Marine Corps veteran and was associated with the U.S. Atomic Energy Commission before joining Dale Electronics, Inc.

New president for Industrial Wire and Cable Ltd.

The directors of Industrial Wire and Cable Ltd. have appointed **G. Douglas Zimmerman** as president of the company. He will continue as president of an associated company, C. P. Clare Canada Ltd.

Telephone pioneer dies

C. F. Sise, a director of Bell Telephone Co. of Canada, died in Montreal General Hospital November 10 at the age of 86. He was the son of the founder of Bell Telephone Co. of Canada and served as the company's fourth president from 1925 until 1944. At that time he became chairman of the board, a position he held until 1953.

Mr. Sise was born in Boston but studied at Lincoln College, Sorel, Que., and graduated in electrical engineering from McGill University in 1897.

Elcom appoints component sales representative

Elcom Marketing Ltd. has appointed **George C. Gibson** to the firm's staff with responsibility for component sales to industrial electronic, electrical apparatus and appliance manufacturers. Mr. Gibson has been with Philco Corp. of Canada Ltd. for the past five years with responsibility for sales, first in Northern Ontario, then in Toronto West. Prior to that he was service manager for Hallicrafters Canada Ltd. for three years. During World War II he was loaned by the RAF to assist in the training of wireless operators at No. 1 Wireless School in Montreal.

Gibson

Vallillee

Brian Engineering sales appointment

Brian Engineering Ltd. has appointed **Bruce Vallillee** as supervisor of electronic sales in the Ontario marketing area. He will be located at 2773 Dufferin Street, Toronto.

Breslau student wins Electrohome educational award

The $3,600 Dominion Electrohome Industries Ltd. electronics educational award has been won by **David Mader** of Breslau, a graduate of Kitchener-Waterloo Collegiate Institute. The award consists of $1,600 to the winner over four years plus $500 per year to the college or university which he attends. Mader, who averaged 88.33% in nine senior matriculation exams, will attend the University of Toronto.

(Continued on page 54)

Binions

Hewitt

Given

Smith

CN-CP Communications introduces high-speed facsimile service

A new high-speed public facsimile service between Toronto and Montreal was inaugurated last month by Canadian National and Canadian Pacific Tele-Communications.

The new system, known as Wirefax, is the first of its kind in Canada and will instantly reproduce an exact copy of typed or handwritten letters, reports, drawings, sketches and other documents between the two cities.

Wirefax receiver, which deposits iron on electrolytic paper at a rate dependent on the signal strength. Chemicals in the paper react to produce spots of varying density corresponding to the document being copied.

Wirefax facsimile service is offered on the same basis as the telegram. The material to be copied can be picked up or delivered by messenger. It is also possible to use the service on a collect basis.

CN-CP expect to extend Wirefax to other centres as demand for the service increases.

Lear holds Production Sharing Symposium in Toronto

An invitation to solicit a share of $30 million worth of business was extended in October to the Canadian defense industry by the Instrument Division of Lear, Inc., manufacturer of military aircraft and missile equipment for U.S. defense programs.

The invitation was issued at a two-day Production Sharing Symposium in Toronto called by Lear in cooperation with DDP and Lear's Canadian representatives, Railway and Power Engineering Corp. Ltd.

Fifty Canadian defense firms were represented at the meeting, which was called to help locate additional sources of supply for items such as gear trains, electronic assemblies, miniature precision slip rings, transformers, motor generators, synchros, aluminum castings, and rotary components.

Lear spokesmen said that the amount of sub-contracting business awarded to Canadian firms would depend entirely on the quality and prices offered in open competition with U.S. companies.

C. C. Meredith becomes CTS of Canada

C. C. Meredith & Co. Ltd., Streetsville, Ont., has changed its corporate name to CTS of Canada Ltd. Founded in 1924, the firm has established itself as a major supplier to Canada's electronics industry.

Both plant and product line have recently been expanded. A newly completed 9000-sq ft building increased total plant area to 50,000 sq ft. Recently added new products are selector switches, battery chargers, 400-cps motor generators, diesel electric generators, control panels, switchboards, and photo-electric lighting controls. Other products manufactured for many years include the CTS line of switches and variable resistors.

No changes in personnel or plant operations are planned as a result of the name change.

Manufacturers appoint representatives

Union Switch & Signal, Division of Westinghouse Air Brake Co., Swissvale, Pa. have appointed **Power Service Products,** Toronto as their Ontario and Quebec sales agents (miniature relays and data readout instruments).

(Continued on page 54)

Ottawa report

Eight Japanese television stations started broadcasting in color this fall.

By coincidence, this item in the Embassy publication "Japan Reports" appeared a few days after the Board of Broadcast Governors had ruled against color telecasting by the public or independent Canadian stations.

The publication states that currently the price of color television keeps it to a small market and it is used mainly for display in public places such as railway and bus waiting rooms, museums and galleries.

However, one of the most popular programs on Japanese color television might not go over so well in Canada: the traditional art of flower arranging.

Operators of mobile radio systems, as used in taxis, police cars, and fire trucks, have been warned not to take advantage of cut-priced equipment on sale in the United States.

W. A. Caton, Controller of the Transport Department's Radio Regulations Division, said that used equipment on sale in U. S. surplus outlets does not meet Canadian specifications and therefore cannot be licensed.

"Apparently taxi drivers have being going across the border to buy the low-priced equipment, installing it and selling their own more costly units to make a profit," he said. "This will only get them in a jam as the American equipment cannot be licensed here and so cannot be operated."

On September 1, following similar action in the United States, the Department reduced the spacing of channels from 60 kc to 30 kc in heavily populated areas in southern Ontario, Quebec and British Columbia.

To meet the danger of increased interference, the Department, in conjunction with the Canadian Radio Technical Planning Board in Toronto, issued more stringent specifications which have to be passed before any new equipment can be installed.

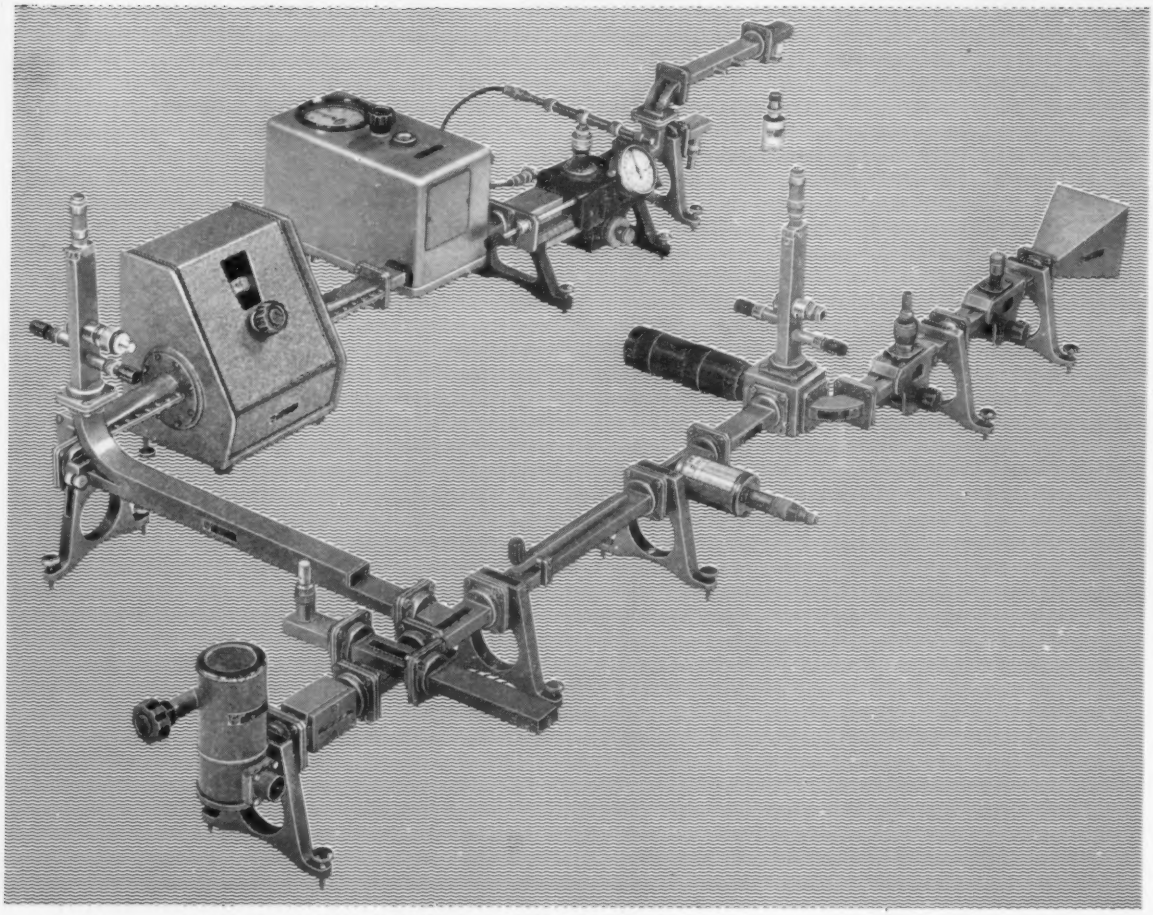
None of the surplus U. S. equipment meets those 30-kc specifications.

Mr. Caton said taxi operators would be better advised to adjust the deviation of their 60-kc equipment to minimize interference, and when they decide to replace it to buy only approved 30-kc units.

Looking to the future Mr. Caton said he expected there would eventually be further reductions in spectrum spacing and commented that individual samples of equipment operating at 15 kc had been offered to the department for testing.

Microwave equipment

for the X and Q band



Measuring bench for 8.2-12.4 kMc s

PHILIPS *electronic measuring*

Sold and serviced by Philips Organizations all over the world
Further information will gladly be supplied by:
Philips Electronics Industries Ltd.,
Leaside, Toronto 17, Ont. - Montreal: 8525 Decarie Blvd.

X TYPE	DESCRIPTION	MAX. VSWR.	
PP 4020 X	Straight Waveguide Section	—	Length 10, 20, and 40 cm
PP 4025 X	E-plane Bend	1.07	Radius of curvature 29 mm
PP 4030 X	H-plane Bend	1.07	Radius of curvature 29 mm
PP 4035 X	Twist	1.10	Length 187 mm
PP 4040 X	Shunt Tee	—	Length 80 mm
PP 4045 X	Series Tee	—	Length 80 mm
PP 4050 X	Hybrid Tee	—	Decoupling > 40dB
PP 4070 X	Waveguide/Coaxial Adapter	1.50	50 Ω N-connector
PP 4080 X	Horn	1.25	Directivity: E-plane 20°, H-plane 25°
PP 4090 X	Multi-hole Directional Coupler	1.05	Directivity: >40dB, coupling factor 10dB or 20dB (± 0.2dB)
PP 4095 X	Cross-guide Directional Coupler	—	Directivity: 20dB, coupling factor 26dB (± 0.5dB)
PP 4110 X	Fixed Attenuator	1.10	Attenuation 6, 10 or 20dB (± 0.2dB), max. peak power 1 kW
PP 4130 X	Variable Flap Attenuator	1.15	Max. attenuation > 20dB
PP 4150 X	Variable Rotary Attenuator	1.15	Max. mean power 1 W, max. attenuation 50dB, accuracy ± 2 %
PP 4170 X	Low-power Matched Load	1.05	Max. mean power 2 W
PP 4200 X	Klystron Mount	—	When using klystron 2K25 the output power is > 20 mW
PP 4220 X	Adjustable X-tal Mount	1.10	Sensitivity: 1 mV D.C. for 0.1 μW, 50 Ω N-connector
PP 4225 X	Broadband X-tal Mount	1.50	Sensitivity: 1 mV D.C. for 10 μW, 50 Ω BNC-connector
PP 4245 X	Tunable Thermistor Mount	1.10	Freq. range 8.2-11 kMc/s, 50 Ω BNC-connector
PP 4260 X	Calibrated Short Circuit	>100	Accuracy of the displacement 0.02 mm
PP 4280 X	Sliding Screw Tuner	from 20 to > 1.02	Insertion loss for a VSWR of 20 is > 2dB
PP 4290 X	Direct Reading Wavemeter	—	Freq. range 8.5-9.8 kMc s, absolute accuracy ± 2 Mc/s, loaded Q 10,000
PP 4300 X	Broadband Wavemeter	1.10	Relative accuracy 3.10^{-4}, loaded Q > 3,000
PP 4360 X	Measuring Cavity	—	Freq. range 8.65-8.95 kMc/s, loaded Q > 3,000, magnetic field for electron resonance 3,300 gauss
PP 4380 X	Standing Wave Detector	1.05	Accuracy of the probe displacement 0.01 mm, 50 Ω BNC-connector
PP 4385 X	High Precision Standing Wave Detector	—	Measurable VSWR between 1.005-2.000, accuracy probe displacement 2 μ, probe penetration 0-3 mm
PP 4421 X	Ferrite Isolator	1.15	Freq. range 8.5-9.6 kMc/s, forward att. < 0.8dB, reverse att. > 13dB, max. peak power 50 kW
PP 4422 X	Ferrite Isolator	1.20	Freq. range 8.5-9.6 kMc/s, forward att. < 0.5dB, reverse att. > 20dB, max. mean power 1 W
PP 4500 X	3 cm Noise Generator	>1.20	Noise factor 18.7dB (K50A), attenuation 0-13dB

Additional Instruments: **D.C. Microvoltmeter, type GM 6020 - Klystron Supply, type GM 4561 - Bolometer Bridge, type GM 4460**

Q TYPE	DESCRIPTION	MAX. VSWR.	
PP 4020 Q	Straight Waveguide Section	—	Length 5, 10 or 20 cm
PP 4025 Q	E-plane Bend	1.07	Radius of curvature 35 mm
PP 4030 Q	H-plane Bend	1.07	Radius of curvature 37 mm
PP 4035 Q	Twist	1.07	Length 50 mm
PP 4050 Q	Hybrid Tee	—	Decoupling > 35dB
PP 4080 Q	Horn	1.15	Directivity: E-plane 15°, H-plane 16°
PP 4130 Q	Variable Flap Attenuator	1.15	Max. attenuation > 20dB max. mean power 200 mW
PP 4150 Q	Variable Rotary Attenuator	1.15	Max. attenuation 50dB, accuracy ± 3 %
PP 4170 Q	Low-power Matched Load	1.05	Max. mean power 1 W
PP 4200 Q	Klystron Mount	—	When using klystron 55,335 the output power is 100 mW
PP 4222 Q	Adjustable X-tal Mount	1.25	50 Ω BNC-connector
PP 4260 Q	Calibrated Short Circuit	50	Accuracy of the displacement 0.02 mm
PP 4270 Q	Sliding Screw Tuner	from 10 to 1.03	Insertion loss for a VSWR of 10 is > 2dB
PP 4300 Q	Broadband Wavemeter	1.20	Relative accuracy 5.10^{-4} loaded Q > 3000
PP 4382 Q	Standing Wave Detector	1.03	Accuracy of the displacement 0.01 mm max. probe penetration 1 mm, 50 Ω BNC-connector
PP 4420 Q	Ferrite Isolator	1.15	Freq. range 33-36 kMc/s, forward att. < 1dB reverse att. 13-26dB, max. mean power 200 mW

Additional Instruments: **Klystron Supply, type 4485 - D.C. Microvoltmeter, type GM 6020**

special purpose and power tubes

Why has Canadian Marconi the widest range?

because it is Canadian representative for English Electric Valve Company Limited and Machlett Laboratories Inc., leading U.K. and U.S. sources of high quality camera tubes, transmitting tubes, rectifiers and heaters. These two great tube companies combine with Marconi's own tube facilities to offer the widest and most complete range of special purpose and power tubes in Canada.

Marconi's own extensive experience in the manufacture of electronic tubes and equipment can also prove invaluable to you in the selection and use of proper tubes and components for your requirements. Call on us for assistance anytime.

ELECTRONIC TUBE AND COMPONENTS DIVISION

CANADIAN Marconi COMPANY

830 BAYVIEW AVENUE, TORONTO, ONTARIO

Branches: Vancouver • Winnipeg • Montreal • Halifax

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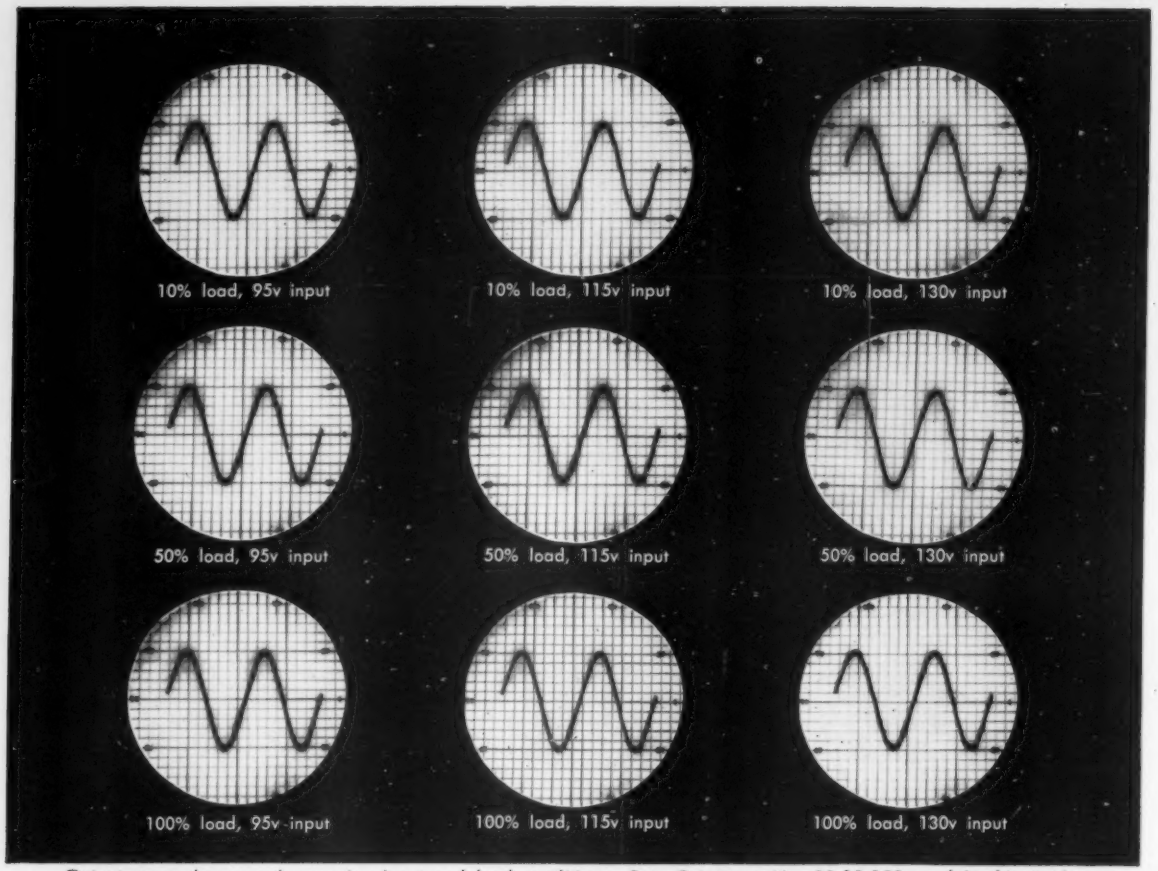

Output wave shapes under varying input and load conditions. Sola Catalogue No. 23-13-150 used in this test.

Sola's moderate-cost static-magnetic voltage regulator has sine-wave output

Sola now offers sinusoidal output in every standard-type regulator *with no price premium.* This development — a result of major design and production innovations — greatly widens the field of use for static-magnetic voltage regulation. The new standard sinusoidal design is now ideal for use with electrical and electronic equipment requiring a regulated input voltage with commercial sine wave shape — especially where harmonic-free supply had previously been too costly. The sinusoidal output also contributes to ease of selection and ordering, since this Sola stabilizer is virtually universal in application.

The Sola Standard Sinusoidal Constant Voltage Transformer provides output with less than 3% rms harmonic content. It automatically and continuously regulates output voltage within ±1% for line voltage variations of ±15%. Average response time is 1.5 cycles or less. The new line includes nine stock output ratings from 60va to 7500va.

Besides the improved electrical characteristics, these units are substantially smaller and lighter than previous models. Size and weight reductions were accomplished without any loss of performance or dependability.

With the Sola Standard Sinusoidal Constant Voltage Transformer you also get all the proved benefits of a static-magnetic regulator. It is simple and rugged. There are no tubes . . . no moving parts . . . no replaceable parts. Maintenance and manual adjustment are not necessary.

Its current-limiting characteristic protects against shorts on the load circuit. It is available in step-up and step-down ratios, allowing substitution for conventional, non-regulating transformers. These units can be used in any electronic or electrical application requiring a regulated sinusoidal power source where the peak power demand does not exceed the capacity of the constant voltage transformer. Circuit design formulae based on sinusoidal wave shape are directly applicable.

Write to your nearest distributor listed below.

Write for Bulletin CVS

SOLA

SOLA-BASIC PRODUCTS LTD.

B·P C

An Affiliate of Basic Products Corporation

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ELECTRONICS

. . . Plotting Today the Road to the Future

CANADIAN AVIATION ELECTRONICS LTD. is a rapidly expanding, international Company, owned and controlled by Canadians, engaged in the development and manufacture of electronic equipment for industry and defense. CAE now serves the governments of Canada, the United States, West Germany, Holland and Belgium.

The Eastern Division of the Company, situated in Montreal, is primarily occupied with the Design, Production, Installation and Maintenance of FLIGHT SIMULATOR SYSTEMS and COMPONENTS: Maintenance of FIRE CONTROL SYSTEMS: Repair and Overhaul of ELECTRONIC EQUIPMENT: Operation of MOBILE TEST EQUIPMENT LABORATORIES: Design of INDUSTRIAL INSTRUMENTATION SYSTEMS: Provision of RESEARCH and DEVELOPMENT services and Manufacture of ELECTRONIC EQUIPMENT.

The Western Division, with headquarters at Winnipeg, is responsible for the Operational Maintenance of the Western Section of the MID-CANADA LINE: Depot and Field Maintenance of the PINETREE LINE: Provision of RESIDENT FIELD ENGINEERS AND TECHNICIANS: Repair and Overhaul of ELECTRONIC EQUIPMENT and the Operation of MOBILE RADAR and TEST EQUIPMENT LABORATORIES.

cae

CANADIAN AVIATION ELECTRONICS LTD. has recently created two United States subsidiary companies; ONEIDA ELECTRONICS INC. in Utica, New York, and CALMONT INDUSTRIES INC. in Los Angeles, California.

CAE is entirely owned and operated by Canadians and offers opportunities for career minded young men to develop in a challenging field with a progressive organization. Applications from electronic engineers, scientists and methods men are invited.

Today, CAE provides jobs for more than 1,200 Canadians in the electronics industries and present commitments alone ensure several hundred additional Canadian jobs within the next 12 months.

CANADIAN AVIATION ELECTRONICS LTD.

MONTREAL • WINNIPEG • UTICA, N.Y. • LOS ANGELES, CALIF.

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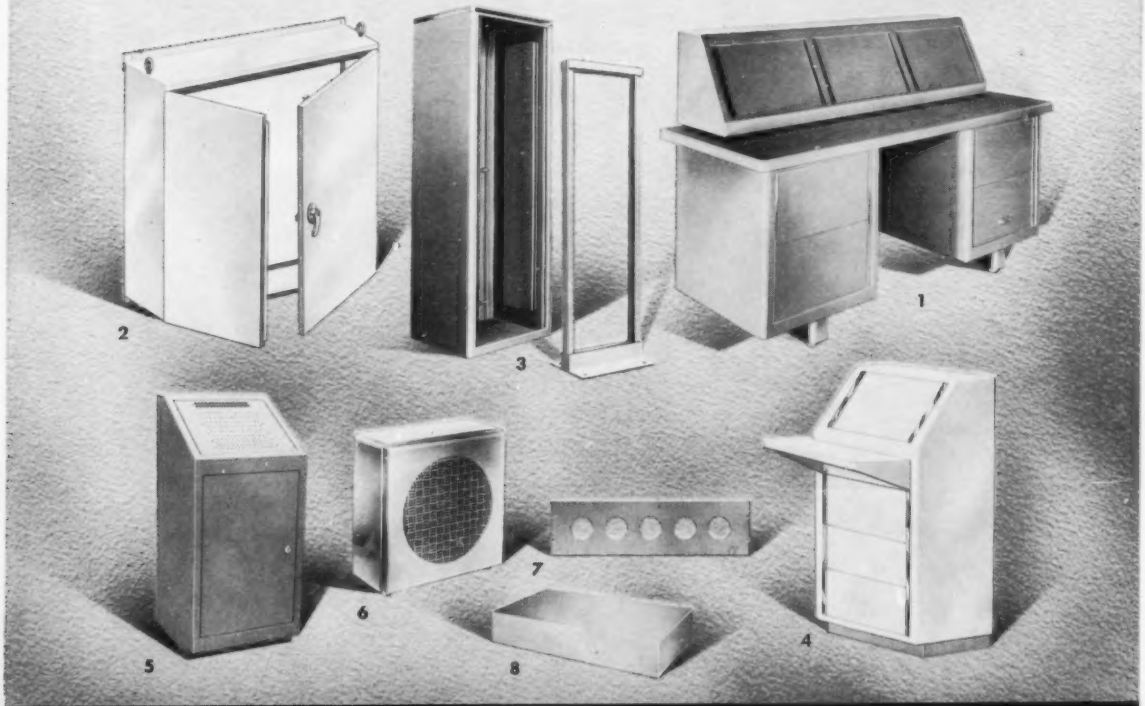
HAMMOND Electrical and Electronic Cabinetry

Cabinets • Racks • Chassis • Consoles • Tables • Drawers • Speaker Enclosures • Utility Cases • Panels • Equipment Covers and Enclosures . . . are all part of the Hammond line.

1. Consoles, Tables and Turrets . . . for communication and control systems.
2. Panel Enclosures . . . N.E.M.A. 12 specs., dust, water and oil-spray proof.
3. Cabinets and Racks . . . for mounting and housing electronic equipment.
4. Modular Consoles . . . designed and constructed for multiple groupings.
5. Special Metal Cabinets . . . for electronic controls in industry.
6. Speaker Enclosures . . . for all sizes—table or wall mounting.
7. Rack Panels . . . steel or aluminum, plain or punched.
8. Chassis . . . steel or aluminum . . . constructed for heavy duty service.



Quality metal work economically fabricated!

Hammond's modern plant is equipped to produce durable, finely finished metalwork to close tolerances and high quality standards for Canadian Industry. The factory carries an extensive range of stock items, and dies used for more than 14,000 original metal fabrications are available to produce special requirements at an economical price.

HAMMOND

ELECTRICAL and ELECTRONIC CABINETRY

Standard Items Stocked by Leading Jobbers

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Clip and file this reference sheet for future use

ROGERS

REFERENCE BULLETIN No. 8

Philips Special Quality Pentode • Philips Special Quality Double Triode for 10,000 hours of guaranteed service

Long, dependable service with a 10,000 hour guarantee is available with two Philips ruggedized special quality tube types E188CC/7308 and E186F/7737. Both shock and vibration resistant, these two types feature very low microphony and noise.
Designed for use in mobile equipment, control equipment, transmitters and studio equipment, the Philips E188CC/7308 and E186F/7737 are recommended as improved replacements offering better microphony and noise properties than types 6922/E88CC and 6688/E180F. The Philips E188CC/7308 is an improved replacement for type 6922/E88CC *at the* same price. The Philips E186F/7737 is an improved replacement for type 6688/E180F.

E186F/7737

Broadband amplifier pentode

HEATING

Indirect by A.C. or D.C.; parallel supply.

Heater voltage	V_f	=	6.3 V
Heater current	I_f	=	320 mA

TYPICAL CHARACTERISTICS AND OPERATION[1]

			A	B
Anode supply voltage	V_{ba}	=	190	180 V
Suppressor-grid voltage	V_{g3}	=	0	0 V
Screen-grid supply voltage	V_{bg2}	=	160	150 V
Control-grid supply voltage	V_{bg1}	=	+9	0 V
Cathode resistor	R_k	=	630	100Ω
Anode current	I_a	=	13	11.5 mA
Screen-grid current	I_{g2}	=	3.3	2.9 mA
Mutual Conductance	S	=	16.5	15.9 mA/V
Amplification factor of G[2] with respect to G[1]	μ_{g2g1}	=	53	
Internal resistance	R_i	=	90	kΩ

1) Operation of the tube under the conditions as given in column A is recommended because of the small spread in characteristics.

2) Life test conditions are:
V_f=6.3 V, V_{ba}=190 V, V_{g3}=0 V, V_{bg2}=160 V, V_{g1}=+9 V, R_k=630Ω, V_{kf}=70 V (cathode negative)
Life expectancy 10,000 hrs.

E188CC/7308

For use as cascode amplifier or cathode follower in RF and AF circuits

HEATER CURRENT			I	II	III
Heater voltage	V_f		6.3		V
Heater current	I_f	=	335	318-352	318-352 mA
TYPICAL CHARACTERISTICS					
Anode supply voltage	V_{ba}	=	100		V[1]
Control grid supply voltage	V_{bg}	=	+9		V[1]
Cathode bias resistor	R_k	=	680		Ω[1]
Anode current	I_a	=	15	14.2-15.8	13.5 mA
Mutual conductance	S	=	12.5	10.5-14.5	9.0 mA/V
Amplification factor	μ	=	33		
Equivalent noise resistance at 45 Mc/s	R_{eq}	=	250		Ω
Noise factor at 200 Mc/s	F	=	4.6		dB[2]
Input damping at 100 Mc/s	r_g	=	3		kΩ
Anode supply voltage	V_{ba}	=	90		V
Control grid supply voltage	V_{bg}	=	0		V
Cathode bias resistor	R_k	=	120		Ω
Anode current	I_a	=	12		mA
Mutual conductance	S	=	11.5		mA/V
Anode voltage	V_a	=	100		V
Control grid voltage	V_g	=	−5.5		V
Anode resistor	R_a	=	1		MΩ
Anode current	I_a	=		< 20	μA
Anode supply voltage	V_{ba}	=	100		V
Control grid supply voltage	V_{bg}	=	+9		V
Cathode bias resistor	R_k	=	680		Ω
Control grid resistor	R_g	=	0.1		MΩ
Control grid current	$-I_g$	=		< 0.1	1 μA

1) V_g hum is the hum voltage referred to the grid. Measured with a fully screened tubeholder and straight response curve of the filter; frequency of the heater voltage = 50 c/s +3 percent of voltage 500 c/s. Centre tapping of the heater supply transformer grounded.

ROGERS

electronic tubes & components

A DIVISION OF PHILIPS ELECTRONICS INDUSTRIES LTD.
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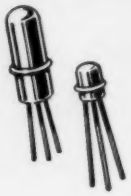
Even in high-frequency and rapid-switching types...



PHILCO OFFERS YOU THE COMPLETE AND

COMPLETELY RELIABLE LINE OF TRANSISTORS:

Whatever the type of transistor you require — however demanding the application — you can fill your requirements from the complete, reliably-built line of Philco transistors.

This table shows a typical assortment of Philco transistors. The line also includes high-frequency and rapid-switching types, in the successful development of which Philco engineers have led the industry.

VHF-UHF Microalloy defused base (MADT) types:
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High-frequency Microalloy types:
2N393, 2N599, 2N600
Medium-powered alloy junction types:
2N1125
High-powered alloy junction types:
2N386, 2N387

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Don Mills, Ontario

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PHILCO *government and industrial dept.*

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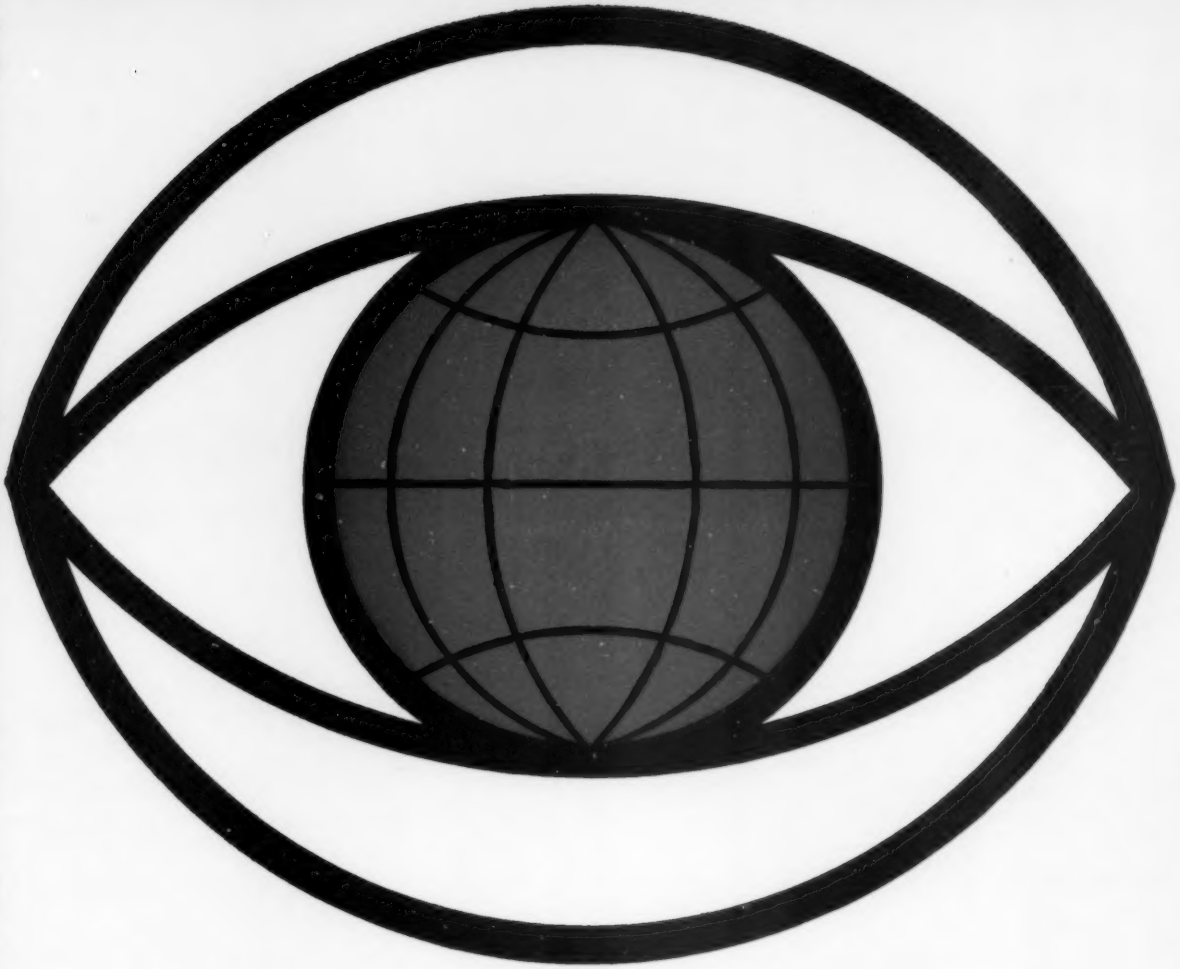

THE AGE OF INSTANT COMMUNICATIONS!

In less literate times the most effective of the communications media were the graphic arts . . . with charcoal and oils each artist re-created, in detail, the newsworthy events of each and every era.

An effective medium — yet limited! The delay between event and artist's conception was lengthy; circulation of the work restricted.

Now the camera has replaced the canvas; graphically recording, in just a fraction of a second, the scenes and events which once required days . . . even weeks . . . to re-create!

Today, the speed of the camera, coupled with a vast network of mass-media, has resulted in an audience of world-wide potential!

As the camera has radically accelerated world news coverage, so has STC contributed equally to this age of 'instant' communications!

Fifty-seven of the world's most progressive countries have established communications networks . . . telephone, telegraph, radio, television and microwave links . . . all designed, manufactured and installed by Standard Telephones and Cables.

AMONG THE FOREMOST IN WORLD COMMUNICATIONS!

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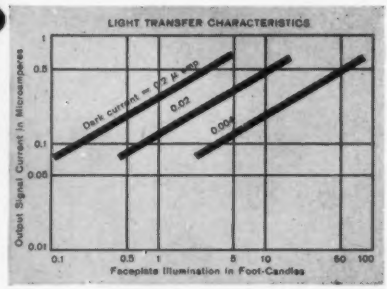
4 TIMES THE EFFECTIVE SENSITIVITY

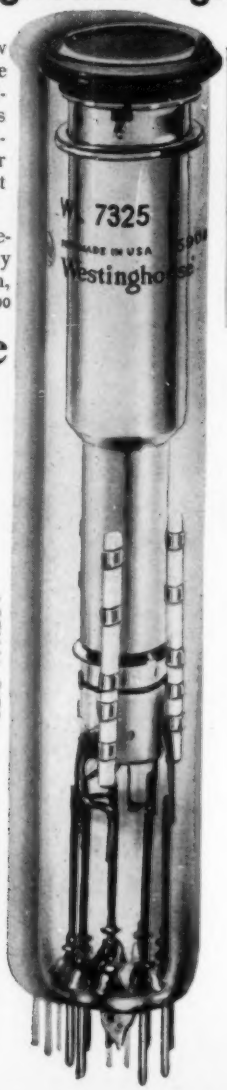
in the new WL-7325 Westinghouse High Sensitivity Vidicon

Four times the effective sensitivity in this compact new Westinghouse Vidicon! Designed to replace directly type WL-6198A with an increase of two times in intrinsic sensitivity, plus an additional two-to-one increase because its greater uniformity permits operation at higher target voltages. A lower gamma results in a wider contrast range or better gray scale and emphasizes sensitivity at low light levels.

Available now in production quantities! For more detailed information, write Canadian Westinghouse Company Limited, Electronic Tube Division, Box 510, Hamilton, Ontario. 60D800

YOU CAN BE SURE... IF IT'S Westinghouse





ACTUAL SIZE

For further information mark No. 23 on Readers' Service Card

The story behind a brief to the Royal Commission on Publications

Why Canada needs a Canadian business press

Does Canada need a business, professional and technical press of its own? Does this section of the periodical press of Canada contribute to the development and maintenance of the national economic health? Can Canada afford to weaken its independent, Canadian-owned business press?

The business press of Canada is a vital bulwark against further technological and financial dependence upon the United States.

These are the issues behind the brief presented to Canada's Royal Commission on Publications by Business Newspapers Association of Canada.

BNA represents some 144 Canadian-owned business, trade, professional, technical and industrial publications, published in English and French. The advertising revenues of BNA member-publications account for two-thirds of the $30 millions in advertising placed annually in Canadian business media.

Among the members of Business Newspapers Association of Canada are the official publications of such respected bodies as the Canadian Manufacturers Association, the Canadian Chamber of Commerce and the Engineering Institute of Canada.

The purpose of the modern business publication might be described as:

1. *To collect and disseminate the experience of those engaged in a certain industry, profession, or trade.*
2. *To act as interpreter of events and developments.*
3. *To serve as a leader of sound thought and policy.*

Canada's business publications play a vital role in Canadian business, professional and industrial life; they are indeed the principal instruments of adult education and training.

The rapid post-war industrialization and development of a complex business community in Canada has made the business executive more conscious than ever of the need for accurate information and sound interpretation.

Business papers in Canada have established themselves as recognized sources of reliable information and ideas—latest inventions, newest developments and technological advances, new production methods, engineering and operating practices, progressive merchandising and retailing techniques, up-to-date economic thinking and policies—without which the Canadian businessman could be operating as he did years ago.

Canadian business publications gather information and attitudes from all corners of Canada and, as a result, many individual business decisions—to buy, to invest, to build or to renovate—are influenced by ideas gained in reading the mature Canadian business press.

It is the function of a good business publication to lead and guide industry thinking; business papers' importance to Canadian business and industry . . . indeed upon Canada's economic health . . . cannot be overstressed.

Here are a few examples of the contribution made by the Canadian business press to business and public life:

¶ A Canadian metalworking publication recently completed a massive census of Canada's metalworking production equipment, a task never before undertaken either by business or government. It revealed that much of this equipment was obsolete, undoubtedly contributing to plant inefficiency.

¶ A Canadian business magazine founded and annually sponsors the Canadian Furniture Mart, which has become the major marketplace for the exhibition and purchase by retail buyers of furniture made in Canada.

¶ A group of Canadian electrical business magazines were responsible for inaugurating the Plantpower Program—an educational activity designed to increase the safety and efficiency of electrical installations in Canada's industrial buildings. This program has since been adopted as a technical service by almost every major Canadian electrical distribution utility.

¶ Another Canadian electrical magazine was responsible for the inauguration of a safe home-wiring program, which has since been adopted by fire departments all over the country, following a series of daily newspaper articles, written by editors of the magazine. In at least one province, changes in legislation for greater public protection resulted from this magazine's activities at the public and industry levels.

¶ A Canadian plumbing and heating journal exposed the public hazards

of unqualified installers of natural gas equipment. A series of articles by the magazine's editors, later reprinted in the daily press, resulted in new legislation and stricter control in the public interest.

¶ A Canadian construction magazine last year published a special section on the problems and prospects of winter construction in Canada—a peculiarly Canadian problem. This special section was later reprinted and distributed widely by the Federal Government as part of its program to promote winter construction.

¶ A Canadian packaging magazine was responsible for the foundation of one of Canada's largest trade and technical associations—the Packaging Association of Canada, along with the major Canadian National Packaging Exposition.

¶ A Canadian business publishing company provides a daily reporting service of construction contract awards. Published in a monthly business magazine, these are widely quoted and used in the industry, the daily press and by the Dominion Bureau of Statistics as an authoritative data source.

¶ A business publication serving Canadian retailers in the fashion field realized that, in general, Canadian retailers did not give due recognition to Canadian fashion design. The publication, through a series of articles, impressed this upon the manufacturers and got them to support the establishment of the Canadian Couturier Association, which since has flourished and has, of course, been responsible for the acceptance of Canadian designs which nowadays are shown internationally.

These may seem dramatic and extraordinary examples of the service Canadian business publications render for Canadians. This list can be duplicated one-hundred-fold. Canadian business publications report in detail to Canadians about Canadian professions, technologies and business and provide a platform for Canadian technicians and professional men to address their colleagues on matters of importance.

The national periodical press of any country plays a significant role in the cultural, political, economic and social life of its people. The Canadian business press provides the specialized information needed by Canadians in business and industry.

In Canada, this task takes on a far greater importance because the Canadian people are exposed to such a continuous flood of U.S. opinion and information and Canadian business to continued competition from abroad.

Canada's geographical position, its standard of living, its industrial and commercial development and the language of the majority of its population, leave its business community particularly vulnerable to influence from the U.S.

Business Newspapers Association of Canada believes that a Canada which did not have its own business press would have a much smaller chance of preserving and developing its national identity in the international business world. Yet Canadian business publications are being exposed to very strong competition from foreign publishers on a scale which would seriously threaten the industry's continued existence.

Canadian business paper publishers feel that it is vital that Canada not only retain but develop and strengthen her national identity. Obviously, U.S. publications are edited for U.S. audiences, reflect U.S. philosophies and sell the U.S. business way of life.

The overflow circulation of foreign publications into this country—in the case of U.S. business publications alone over one million copies a year—must have a tremendous influence on Canadians—particularly on our younger business people. The total effect of these publications on the economic and cultural life of Canada is that they, through their editorial and advertising pages, make Canadians most aware of "the American business way of life;" we are in grave danger of becoming pale shadows of U.S. citizens.

For these reasons, we believe, the preservation of a truly Canadian business press is vital to support and foster our national identity as Canadians.

U.S. business publications do not merely overflow into Canada; they compete aggressively for the advertising which is almost the only source of revenue for the Canadian business press. There is increasing competition from U.S. business publishers who offer to Canadians so-called "Canada editions"—a version of the parent magazine with little or no Canadian editorial content and wholly Canadian advertising—or "split-runs," in which the U.S. publisher sells his Canadian circulation separately to advertisers interested in Canada without Canadian editorial content.

If Canadian business publications were to be weakened by "Canada editions" or split-runs of U.S. business publications, the Canadian manufacturer would be at a serious marketing disadvantage vis-a-vis his U.S. or foreign counterpart, who would purchase advertising in these "Canadian" publications at a fraction of the cost of wholly Canadian media.

Canadian business and industry as a whole thus has a vital stake in the preservation of a truly Canadian business press.

Not only is the Canadian business press a vital medium of technical communication which helps keep Canadian industry efficient; it is an important marketing tool for reaching Canadian business buyers with advertising messages from manufacturers and suppliers.

Without a Canadian business press, the competitive pressures on Canadian business could only increase.

Many Canadian industries are subject to extraordinary foreign competition. The Canadian business publishing industry is not alone in this. But because of its peculiar importance to Canada, the position of the Canadian business press, we believe, deserves the attention of Government and industry.

We submit that Canada's business press is a priceless national economic asset which we dare not leave at the mercy of extraordinary competition from abroad.

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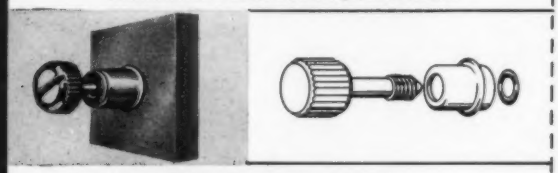
For fastening and releasing rack units *your choice of two*

SOUTHCO®

SCREW FASTENERS

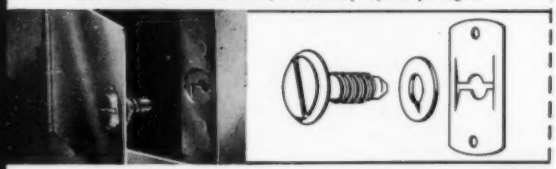
RETRACTABLE SCREW

Your choice of 5 head diameters, 6 thread sizes



SLOTTED HEAD SCREW

Your choice of 2 diameters, 3 head styles, many lengths



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Fast to install and economical, Southco Screw Fasteners provide secure fastening and quick release for panel and rack consoles.

Misalignment is easily handled as screws float in oversized holes which allow ample play for "lining up". No special installation tools are needed.

Retractable screws are stainless steel or brass, polished chrome-plated. Stand-off is brass, retaining rings are available in a variety of materials. Screw Fasteners are carbon steel, cadmium-plated, eliminate thread-tapping.

● For complete information on these and other fasteners, send for your free copy of Southco Fastener Handbook. Southco Division, South Chester Corporation, 242 Industrial Highway, Lester, Pa.

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SOUTHCO FASTENERS LION

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IBM 1620 *data processing system*

...the most powerful engineering computer in its low price class

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Transistorized throughout, the IBM 1620 has a 20,000-digit magnetic core memory with variable field length and immediate accessibility. Its input-output notation, on paper tape and console typewriter, is in convenient decimal arithmetic. It can perform more than 100,000 calculations a minute and is easily adapted to your engineering problems.

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balanced data processing IBM

INTERNATIONAL BUSINESS MACHINES COMPANY LIMITED
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the new generation of
MAGNET WIRES

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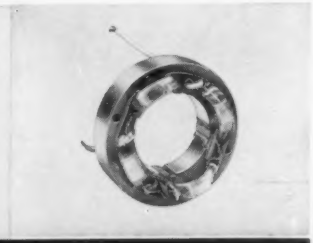
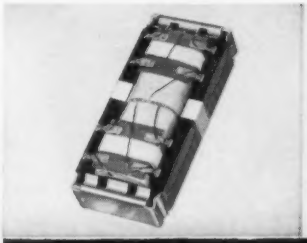
FORMEL
The best general purpose magnet wire now being manufactured. It is a vinyl acetal coated wire that has many outstanding properties for use in equipment functioning at temperatures not exceeding 105°C.



Fan Motor Stator Winding



Fluorescent Lamp Ballast Transformer Coil

NYLON
A polamide coating wire characterized by excellent windability and ability to solder in dip operations at temperatures of 650°F. to 750°F. without prior removal of coating.

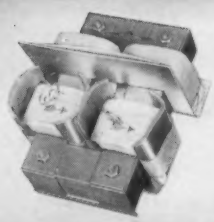
BONDEL
A Formel insulated wire with a thermoplastic cement overcoat. This overcoat softens when exposed to heat (275°F.) or solvent (alcohol). Will bond the wires in a desired shape on cooling.

Deflection Yoke Coil for Television

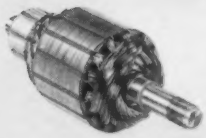
Electronic IF Transformer Coil

POLYSOL
A modified isocyanate coated wire characterized by its excellent electrical properties (particularly at high frequencies) and its ability to solder in dip operations without prior removal of the insulation.

PLAIN ENAMEL C-90
Insulated with an oil resin varnish film. Provides outstanding electrical properties in very thin film build-ups.



Oil Burner Ignition Coil



Automotive Generator Armature

POLYSOL-N
Polysol insulated with a nylon overcoat. Combines the excellent windability and solvent resistance of nylon with the outstanding electrical characteristics of polysol. For soldering in dip operations without prior removal of coating.

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Canada Wire and Cable Company Limited

MAGNET WIRE DIVISION—SIMCOE, ONTARIO

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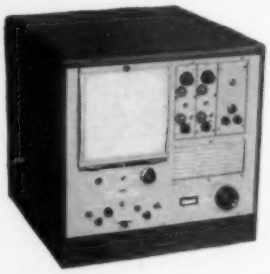
Here's the *only* X-Y instrument today that gives you extremely *fast response time — direct, large area recordings — 1% linearity:* the SANBORN MODEL 670A X-Y RECORDER. The capabilities of the 670A make it particularly valuable in such applications as rapid recording of diode and transistor characteristics . . . hysteresis curves for control systems, gyros, servo valves, magnetic coils; velocity or acceleration vs. vibration of mechanical elements.

Inputs to each axis are through interchangeable "850" series preamplifiers, and can range from microvolts to volts. With Model 850-1500A Low Level preamplifiers, 62.5 uv gives a 1" chart deflection; with Model 850-1300B DC Coupling preamps, 31.25 mv gives 1" chart deflection. To record one variable against time on the X-axis, the Model 670-800 Time Base Generator is also available. A plug-in MOPA is available to supply fixed frequency excitation to preamplifiers.

Recordings are made on 8" x 8" daylight-loading, ultraviolet-sensitive charts by an optical (light beam) recording system. The trace may be monitored on phosphorescent screen before recording, beam intensity is adjustable for maximum sharpness, and X and Y axes may be recorded directly on the chart. Brief post exposure in room light develops the record.



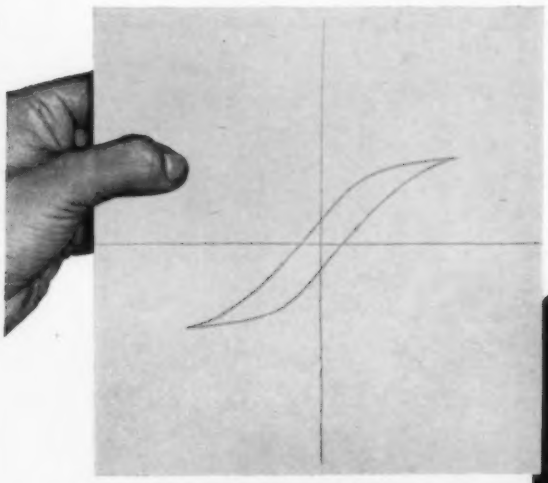
SPECIFICATIONS

Input: single-ended or push-pull
Input Impedance: 5 megohms from each high input terminal to ground with 850-1300B preamplifier
Frequency Response: to 130 cps within 3 db at 8" peak-to-peak deflection
Sweep Rates with Time Base Generator: from 0.01 to 2 seconds
Output Drift: 0.04 inch /hour with 850-1300B
Packaging: Optional cabinet 21¼" x 20" x 20" high, or can be rack mounted in 15¾" of panel space
Power Requirements: 450 watts, 115 volts, 60 cycles AC

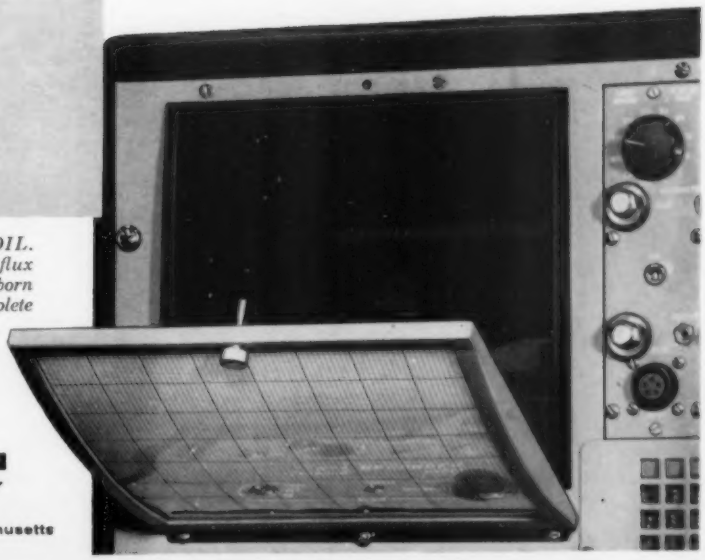
Ask your local Sanborn Sales-Engineering Representative for complete information on the Model 670A X-Y Recorder, or write the Industrial Division in Waltham, Massachusetts.

Record 100th-of-a-second X-Y variables directly

- *at 2500"/sec. writing speeds*
- *on 8" x 8" charts*
- *with 1% linearity*
- *from microvolts to volts*



HYSTERESIS IN MAGNETIC COIL. This plot of magnetomotive force vs. flux density was recorded on the Sanborn Model 670A X-Y Recorder. The complete trace was made in 1/60th sec.



SANBORN COMPANY
INDUSTRIAL DIVISION
175 Wyman Street, Waltham 54, Massachusetts

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71A . . . a new family of light-route radio systems by Lenkurt

The new Lenkurt 71A light-route radio equipment is available for operation in the 150 mc, 450 mc and 900 mc bands. It provides toll-quality transmission of up to thirty multiplexed voice channels over distances of up to 500 miles or ten tandem repeater sections. Greater channel capacity can be obtained over shorter distances.

Designed for high-reliability service, the 71A utilizes proven circuit techniques, and rugged long-life tube types. The transmitter, receiver and power supply are in one compact unit requiring only 17½ inches of rack space. The front panel of the terminal hinges out to provide front access to all components.

Built-in metering facilities permit complete in-service performance testing and maintenance checks.

Transmitter power output and receiver noise alarms are provided including both local indication and facilities for connection to remote equipment.

Automatic transfer panels and combiners are available for applications requiring diversity operating standby, or hot standby systems. Service channel equipment including order-wire and supervisory units, is also available.

The Lenkurt 71A light-route radio equipment was designed and manufactured in Canada.

For complete information on this new light-route radio by Lenkurt, call or write Automatic Electric Sales (Canada) Limited, 185 Bartley Drive, Toronto, Ontario. Branches across Canada.

6063

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CANADIAN
ELECTRONICS
ENGINEERING

Electronics in Canada needs a voice

The Royal Commission on Publications began its hearings in Ottawa last month and is now receiving submissions in other centres across Canada. What does this mean to you, the readers of Canadian Electronics Engineering?

The Commission has been appointed to take a hard look at the position and prospects of Canadian periodicals, particularly with respect to foreign competition, and to recommend measures that would help the further development of a Canadian identity through a genuine Canadian periodical press.

Three kinds of competition have been brought strongly to the Commission's attention: high-volume overflow circulation of U. S. publications into this country; so-called "Canadian editions"; and split advertising runs. Canadian consumer magazines have already been hit hard by these forms of competition from U. S. publishers. Canadian business publications like Canadian Electronics Engineering are beginning to feel its effects.

In 1949, there were 510 U. S. business papers with a total circulation per issue in Canada of 225,513; by 1959 these figures had grown to 1,497 papers, with a Canadian circulation per issue of 1,122,580. Yet over a similar period, from 1950 to 1960, total circulation of Canadian business papers, which now number about 400, only increased from 1,164,718 to 2,731,269.

Canadian business publications are playing a vital role in Canadian business, professional, and industrial life. Canadian Electronics Engineering, for example, provides a medium for the dissemination of technical information and business news in the field of electronics, with emphasis on Canadian application and significance. Its editors constantly have in mind the interests of readers in all branches of the Canadian electronics industry, and in other Canadian industries using electronic equipment in their products, services, or manufacturing processes.

Our pages provide a forum for the exchange of information between our readers, particularly technical articles describing Canadian developments and applications. Many of these stories would never be told if there were no Canadian technical press. In addition, the regular circulation of Canadian Electronics Engineering to Canada's Trade Commissioners abroad and to procurement officers in the major U. S. defense electronics manufacturing companies, helps to secure international recognition for Canadian electronic products.

In our special issues on subjects such as Defense Production Sharing, Microwave Communications in Canada, and Industrial Electronics, and in our annual Directory and Industry Review & Forecast issues, Canadian Electronics Engineering provides a unique service to the Canadian industry. What is more, every issue provides an opportunity for anyone with the future of Canadian electronics at heart to express his opinions.

The Canadian electronics industry can only survive in an economic climate which permits it to develop new products and face fair competition in domestic and world markets, Canadian Electronics Engineering, working in a similar climate, can aid the industry by continuing to provide the uniquely Canadian information so necessary to the development of electronics in Canada.

THE EDITOR

ERIC W. LEAVER, MEM. I.R.E., P.ENG.*

Mr. Leaver, a well-known authority on automation topics, keynotes our feature report by examining some of the problems of Canadian manufacturers of industrial electronic equipment. These are classified as problems generated by the manufacturers, by their customers, by government, and by Canada's geography. He concludes that the development and aggressive marketing of unique products will provide the main solution to many of these problems.

Problems facing industrial electronics manufacturers in Canada

Probably the first response one might expect to the title of this article is: "Are there any?"

Certainly, a great deal of the industrial electronic equipment used in Canada is imported in the form of components, as units, or incorporated as instruments and/or controls in integrated systems. But the answer is: "Yes!"

A few companies like our own develop and/or manufacture industrial electronic equipment in Canada. Others assemble equipment for which designs and, frequently, parts are brought into the country.

But most Canadian electronic equipment companies concentrate on the much larger, more conventional and more lucrative consumer goods market, with occasional forays into defense business.

Many of the problems confronting an industrial electronics manufacturer are standard manufacturing or business problems. Others are broad general situations, characteristic of our country and our time.

I will discuss these problems in terms of those generated respectively by ourselves, our customers, our government and our country.

PROBLEMS GENERATED BY OURSELVES

Criticism, like charity, should begin at home. Industrial electronic manufacturers are responsible for many of their own troubles, some of which could be taken care of by themselves and some by letting other people know that they exist.

One of their problems is that of the small market. I will discuss this in more detail later, but the market is even smaller than it should be, because possible users have not been fully informed as to what is available and what can be designed to help them in the fields of instrumentation and control. Further, potential users are not as aware as they might be of who are the potential suppliers of such equipment. This is detrimental to the user's interests as well as the supplier's, but the onus is strictly on the latter.

There is also the personnel problem of obtaining engineers and technologists with the training and competence necessary in this highly technical and rapidly changing field.

Long range planning, apprenticeship training and a sense of "going somewhere" would be of considerable aid for the "long pull."

Speaking generally in terms of management, labor and the professional sectors of our business, management is not nearly enterprising enough and will not take the chances it should, a curious situation in a "young" country with such an enormous potential for growth. Too often, I think, management hasn't the faith in itself and the country necessary to meet the challenges presented by our place and time.

Actually our opportunities are greater today than ever before, but they are not hanging from trees waiting to be plucked. We usually have to grow our own tree, and tend it well for a long period of time. I may be unduly critical, but I feel that we have the tendency to cry "blue ruin" every time we encounter a setback.

*Electronic Associates Ltd., Willowdale, Ont.

Labor in Canada too often seems to forget that remuneration must necessarily be related to effort, care and skill in about equal proportions, and that if we in Canada are not prepared to work on those terms, there are plenty of others who are not only willing, but anxious to do so.

Again, professional people are not exempt from the idea that remuneration should be based on years since graduation, or degrees held, rather than performance and how much it is worth in the markets of the world.

We need a new sense of purpose in Canada, a new dedication to the progress of our country. We need to know where we want to go, and be prepared to spend some time and effort figuring out how we are going to get there.

PROBLEMS GENERATED BY OUR CUSTOMERS

Like electronic manufacturing companies, many customer companies in Canada tend to be unduly conservative. Some of this seems to be characteristic of Canadians in general, and some is caused by a lack of capital. A small part is pure provincialism.

Perhaps the most frustrating attitude of all is that of mental colonialism, which assumes that anything good must of necessity be invented in the United States, the United Kingdom, or in whatever country happens to be the subject of current admiration.

People holding these views apparently do not realize that Canada, like most other countries, has contributed and is continuing to contribute her share of innovation in the technical field. I am sure there are many Canadian companies, like our own, who are selling Canadian goods abroad in areas where the wage rate is a fraction of Canada's, because we have something unique to offer. Also many companies, again like our own, are licensing developments for manufacture in the U.S. and many other countries.

I think that if these facts were better known, Canadian companies might win greater acceptance of their technical capabilities here at home.

There have been instances where Canadian manufacturers couldn't sell a new product to a Canadian firm directly; the latter insisted on a product available from the U.S. When the product arrived it had a Canadian nameplate for it had gone from Canada to a U.S. distributor and then back to Canada again.

A considerable part of our industry consists of U.S. or U.K. subsidiaries. Some of these look to the parent company for innovations, and only if they are accepted there, will they purchase similar equipment — and then they buy it from the home country.

Happily this is by no means universally true, as some of the staunchest supporters of Canadian industry are members of U.S., U.K., or other foreign-owned companies, which include some of the most technically progressive companies in the country.

Conservatism towards new instrumentation and controls is costing Canadian industry large sums of money. Admittedly many potential users have had unfortunate experiences, often resulting from buying cheap "off-the-shelf" type equipment, but these have led to an unnatural bias against electronic devices in general. This has prevented the purchase of much equipment that would quickly pay for itself.

This attitude is a major factor in limiting the expansion of the Canadian market. Yet greater volume with its accompanying reduction in prices would increase our chances of competing successfully in other markets.

The person who actively wants to purchase money-saving equipment and will admit this to a sales engineer is a rare phenomenon in Canada.

Yet in Europe, particularly in Germany where post-war progress has been so outstanding, this seems to be the rule.

The difference in attitude is most marked and it would appear that a short course in the power of positive thinking — and I don't except our industry, our company or myself from this — would be most beneficial to industry as a whole, to the electronic supplier, and to the Canadian economy in general.

Conservatism in Canadian companies is not limited to the attitude of management to possible vendors. Many engineers and foremen have a very difficult time "selling" their own management on new products and methods that would save money, increase production and/or improve their operations. In fact, it is this "breakdown of communications" within such companies that is perhaps the greatest single factor limiting the upgrading of their efficiency and performance.

Still another problem that arises from time to time—happily not often — has to do with proposals. In industrial electronics, a great many requirements are unique. After outlining the requirement, a client may request a concrete proposal. This often requires quite a lot of work in thinking up suitable methods, which is then embodied in a quotation.

It is therefore rather disturbing when one finds a somewhat unique approach has been embodied in someone-else's hardware!

This is not the way to obtain full co-operation from suppliers.

PROBLEMS GENERATED BY OUR GOVERNMENT

Governments today are big and the immutable law of the twentieth century seems to be that they will become even bigger.

This is periodically decried by business, yet business itself seems all too ready to ask for government intervention in its domain whenever events take an unfavourable turn.

It seems to me that it is **not** the job of the Government to get business for a company, to do its research or development for it, or to ensure that its products will always be bought whether there is a need for them or not.

In my opinion, the subsidy of industry — like the subsidy of agriculture — is self-defeating and in the long term disastrous for those who supply the money, for those who distribute it, and especially for those who receive it.

Think of the improvement in our general situation if we could rid ourselves of our "Cross of Wheat", which uses up large amounts of our taxes, sops up foreign exchange that could be used to buy our higher labor- and skill-content goods, and offers an excuse for the wholesale, deadly invasion of our home markets.

There are things, however, that only governments can and should do, things that are their primary responsibility. One of these is to create an environment which encourages industrial initiative, health and vitality, so that industry can **generate** the wealth that it **alone** can provide, for the people and their governments.

Certainly, everyone knows a government has to collect taxes. It is, however, the responsibility of both people and government that taxes should be as low as possible, used as efficiently as possible, and only on worthwhile ends. Further, they should be distributed in such a way that the harmful effects on vital sections of our economy be minimized, and if possible, used to encourage and promote business activity.

Yet here are a couple of examples where I feel this has not been kept in mind, in the direct tax field.

Every time a sale is made, the tax collector takes his percentage in the form of sales tax, often before the

business has collected the money on which the tax is levied.

We want to promote Canadian business, but sales tax is payable on sales and advertising materials vital for its very survival.

Let us consider capital goods.

A great many people express concern over the influx of foreign capital. Actually it has been the greatest blessing this country ever had, because without it most of us would still be wearing Davy Crockett hats!

With all this concern, one would think that some encouragement would be given to the retention of Canadian capital in Canadian business, especially small business, where capital is so difficult to obtain and retain.

But where actual profits are involved, no encouragement is offered to retain them in the business so that it can grow — every dollar must pay its percentage. Surely it would only be common sense to provide reasonable exemptions on money retained for capital purposes.

Further, wouldn't the reduction in taxes more than pay its way if accelerated depreciation were allowed on capital goods having, say, an 80% or more Canadian content?

This would provide double benefits, by aiding the secondary industries supplying capital goods, and encouraging the modernization an defficiency of a large number of highly diverse industries.

Tariffs are usually considered a "must" by home industries. Obviously, however, they can easily become two-edged swords. How can we expect other countries to import at least some of their goods if we won't import theirs?

Another less obvious example of this is in relation to those institutions that can import duty free. The Canadian supplier is at a disadvantage as he may have paid duty on some imported components which are assembled in Canada, while the competitive complete imported goods are subject to no duty at all.

One thing that governments must soon attack is the problem of rules, regulations and papers concerning them. An important component of product cost, which is steadily rising, is the overhead due to the clerical work involving the supplying of information, often over and over again, to many offices on even more pieces of paper. If the present trend continues it may become uneconomic to operate a really small business.

One of the important problems facing the manufacturers of highly technical equipment is that of suitable personnel. I have already referred to the problem in the professional field, but it also exists in the technician's area.

It is a double problem, a lack of trained people to make equipment and a lack of people to maintain it in the field.

It is ironic when hundreds of thousands of men are out of work in Canada that it is difficult to obtain well-trained technicians. While many large industries have well-staffed and competent instrument departments, many others do not have even a single man who can service a photo-relay!

Surely retraining during idle hours of selected unemployed is indicated, and a selling job on industries that can use them is long overdue.

Further, bringing this to the attention of students prematurely leaving school, with educational equipment suitable for the ever shrinking "pick-and-shovel" labor market, would reduce our future headaches in this area.

PROBLEMS GENERATED BY OUR COUNTRY'S LOCATION AND ITS CHARACTERISTICS

One of the most obvious problems is that of the small home market. When one compares the market for industrial electronic equipment in Canada with that in the United States, one is given pause to consider whether its production is practical at all in this country.

Not only is our population only 10% of that of the Untied States, but the healthy flowering of secondary industry is missing here. Thus the market ratio is much greater than 10:1, and may be closer to 100:1 or more.

However, some countries have been extremely successful without a large home market, the watch-making industry in Switzerland being a classic example. The reason here, of course, is the active promotion by the Swiss watch manufacturers of their major market, which lies outside their own country.

The example, I think, is one which we in Canada must emulate if we are to be successful: produce unique high-quality products at reasonable prices, put in an extraordinary large sales effort and gain world markets.

But until we do meet this problem head-on, and develop a large export market, the difficulties of small markets such as the financing of speculative development, the amortization of design and tooling, etc., will continue to plague us.

Another problem, that really clinches the small market situation, is the area over which the Canadian market is spread.

Hundreds and even thousands of miles separate customers with similar requirements. This situation brings to mind the "cow-in-the-pasture" problem in the southern semi-arid regions of the United States. Small clumps of vegetation are located hundreds of feet apart, and one is led to calculate the critical spacing that would result in the cow's expending more energy to go from one clump to the next than its food value would justify!

Good, inexpensive and frequent transportation is therefore a matter of life or death to Canadian industry.

Our proximity to the United States has many advantages and disadvantages. One of the latter is that many Canadians demand a U.S. standard of living while they collect the advantages of a small independent nation.

In effect, this means that labor and engineering cost almost as much as in the United States, but must be sold in a much poorer market in Canada, or compete with goods produced overseas at a fraction of the cost.

Since in many cases this condition can't be met, we loose professional people educated at our expense to the higher-paying U.S. industry.

Either way, go or stay, Canadian industry is laboring under a tremendous disadvantage in this area.

CONCLUSIONS

The Canadian industrial electronics industry must have larger markets if it is to play its part in the growth of the national economy.

It must have the full cooperation of other industries and of government to do this.

But, most of all, it must learn to live with and solve its own problems, standing on its own feet. Continuing development of unique products is the only answer.

There will always be a market for something new that performs a useful function better, more cheaply or quicker, or achieves something that has not been feasible before. No one can think of everything, and that includes the industrial giants of this world: the U.S., the U.K., and the U.S.S.R.

Canada should specialize in this field, so that its industrial electronics manufacturers do not compete with each other or with those in the rest of the world.

Why not "sell" Canada as a country of originality and uniqueness? It would help all of us and, who knows, we might even grow to believe it ourselves! END

Technical institutes begin to overcome technician shortage

Students at Ryerson Institute of Technology study industrial electronics in the electrical technology course. Picture was taken in newly-opened lab.

IAN R. DUTTON, ASSOCIATE EDITOR

A feature of the post-1945 period in Canada has been the establishment of a number of technical institutes to provide training at a level between the skilled workman and the engineer. Federal, Provincial and professional groups are working to improve the courses and standards.

Since the end of World War II, Canada has experienced an important change in several aspects of education. The rapid growth of industry created a demand for scientists, engineers, technicians and skilled tradesmen.

Expansion of existing facilities permitted universities to keep within reasonable distance of the demand for scientists and engineers. Immigration, trade schools and apprenticeship plans helped to supply the skilled tradesmen. But there were few facilities for training technicians.

This has lead to the creation of technical institutes in practically every province to fill the gap between secondary schools and universities. But there is still room for improvement with additional facilities and courses.

While education is a Provincial responsibility, the Federal Government has a direct interest and tries to provide assistance in various ways. The recent Speech from the Throne said Parliament would be asked to approve financial aid for construction of technical schools and training institutions.

The Department of Labour recognizes that higher education is an important means of creating new employment opportunities. Through its staff in the Canadian Vocational Training Branch, the Department has provided guidance and encouragement to Provincial authorities establishing technical institutes. It has also fostered measures to create more uniform graduation standards for similar courses in the various institutes.

Three types of course provided

Industrial electronics technicians are usually the product of one of the basic courses such as electrical technology. Others may have taken an electronics course that includes the study of industrial applications, or a broad course in instrumentation and control that includes electronic techniques.

In its publication "Post-Secondary Technical Education" the Canadian Vocational Training Branch of the Department of Labour, Ottawa, has presented a good summary of the three types of course which could lead to a career in industrial electronics.

Electrical technology

"An engineering technician trained in electrical technology will usually be involved either in the production and distribution of electrical power or in the manufacture of electrical machinery and equipment, or in the controls for the machinery and equipment. He will have to know the principles and theory of electricity. He will need a good background in mathematics and applied physics, and he must be familiar with basic circuitry and theory as they apply to power systems and related control and protective devices."

Electronics technology

"Training in electronics includes considerable work in mathematics and science, the study of electron tubes, electronic circuits and theory, transistors, servomechanisms, television fundamentals, and related subjects. Some curricula in the area of electronics concentrate on industrial applications and may be designated as electronic technology, electronic and electrical technology, or industrial electronics."

Instrumentation technology

" . . . instrumentation is really the technology of measurement and automatic control."

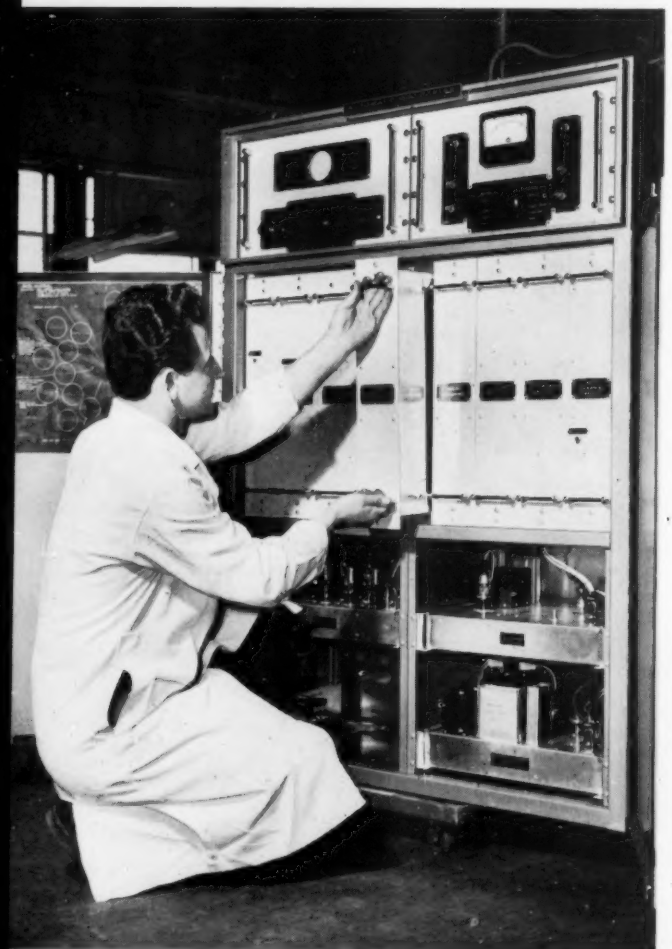
"Often, he (the instrumentation technician) may be responsible for equipment that combines electronic, pneumatic, hydraulic, and perhaps optical features. This means that a well-trained technician in the field of instrumentation must have a broad theoretical background that includes physics, chemistry and mathematics, as well as the scientific technical aspects of instrumentation. He will find this training offered under curriculum designations such as instrumentation technology, or industrial instrumentation technology."

(Continued on page 56)

Procurement decisions must be based on sound economic studies

IAN R. DUTTON, ASSOCIATE EDITOR

The financial relationship between electronic equipment and industrial processes can become very complex. This article, based on studies of actual installations in uranium mines and mills, describes the careful analysis needed to determine the economic advantages of an electronic ore sorter. It considers two typical operating and marketing conditions to show how the ore sorter can reduce cost.



Electronic equipment for the K & H Ore Sorter was designed and built by Electronic Associates Ltd. Modular construction facilitates servicing in remote areas.

Industrial operations thrive on technological advances, but at times it is difficult to predict how new equipment or techniques will affect operating costs and procedures. The problem usually stems from lack of statistics on various parts of an industrial process, rather than on the overall operation. Without a detailed breakdown it may be impossible to show what will happen when some change is made.

This article deals with some of the complex financial planning which may arise when contemplating installation of new equipment. Based on a report from K & H Equipment Limited, Toronto, it uses specific examples from the uranium mining and milling industry to illustrate the testing, calculating and planning which may be involved.

The equipment, which is described later in this article, is an electronic ore sorter capable of sorting out low grade ore before it enters the mill.

In many mining operations the valuable minerals are distributed very unevenly and meagrely within the rock mass which is broken as ore. In the case of most uranium ores the ratio of ore mineral to gangue is in the order of 1:200 (for gold it may be as high as 1:100,000). Many of the individual pieces of broken rocks are, in fact, completely barren, or carry insufficient ore minerals to meet the cost of milling.

By picking out and rejecting these low grade pieces a saving in milling costs can be achieved. Furthermore, if the underground operation can supply sufficient ore to replace the tonnage of rejected waste, the mill will continue to operate at capacity, but the grade of ore treated and value per ton will be effectively increased.

However, other factors may change the situation. The overall operation of the mine and its marketing contracts must be considered.

One or more of the following factors limit the dollar earning capacity of a mine:

a) Grade limitations
b) Tonnage limitations
c) Hoisting capacity
d) Mill capacity
e) Market restrictions

The interaction of these factors determines the economics of sorting for a particular mine. But before calculations can be made it is necessary to undertake a series of controlled assays. When that is done the mine owners are able to base their decisions on fact, rather than on instinct and partial fact.

A significant point for electronics manufacturers to recognize is that tests of this type can be expensive. They should have a good general knowledge of their customers' industry to know what is involved beyond the immediate area where their equipment may be used.

When all the information is available, including the capital and running costs of the new electronic equipment, it is possible to see how operations will be affected. Here are a couple of examples:

Mine 'A' has a fixed grade of ore, but could increase the amount mind and hoisted. The mill is operating at full capacity, but the output of U_3O_8 must be increased

to meet the contract requirements. The decision here is whether to increase mill capacity through expansion of processing equipment, or to increase the outtput of U_3O_8 by sorting out low grade ore before it enters the mill.

Having full knowledge of the capital and operating costs will permit mill owners to make the correct decision.

Mine 'B' is operating under the same conditions as 'A', except that contract requirements for U_3O_8 can be met at only 90% mill capacity. No other markets are available in the foreseeable future.

Here the limit on production is imposed by the contract and the economics of sorting depend on these factors:

1) Decrease in reagent costs per pound of U_3O_8.

2) Decrease in secondary crushing and grinding costs.

3) Elimination of undesirable rock types which poison mill circuits.

4) Sorted waste is available for back-fill.

5) Decrease in soluble losses.

6) Possibility of closing down one line of the mill circuit for part of the year while still producing the same over-all yearly output of U_3O_8.

7) Stockpiling against the contract would enable a mine capable of over-production to take full advantage of any markets which materialize toward the end of the existing contract.

8) If it becomes obvious that the immediate post-contract demand will be so limited that the mine could no longer operate profitably, it may be advantageous to produce sufficient U_3O_8 to fulfill contract obligations and suspend milling operations as soon as possible.

Economic factors related to ore sorting

Several factors common to many uranium mining operations favor sorting equipment to reject low-grade ore. The major ones are:

1) Capital and operating costs of uranium mills are relatively high.

2) Elimination of barren mill feed reduces consumption of expensive reagents.

3) In general, uranium deposits have an uneven pattern of value distribution. The ore is not evenly distributed throughout the rock.

4) Radiogenic shattering of the host rocks and friability of the ore minerals tend to concentrate the valuable ore in the finer fraction of any crushing process.

5) The barren rock types usually are more resistant to blasting and the smashing associated with underground transportation than are the ore types.

6) Radioactivity of the rocks is almost a direct measure of their value, and may be detected and interpreted at high speeds.

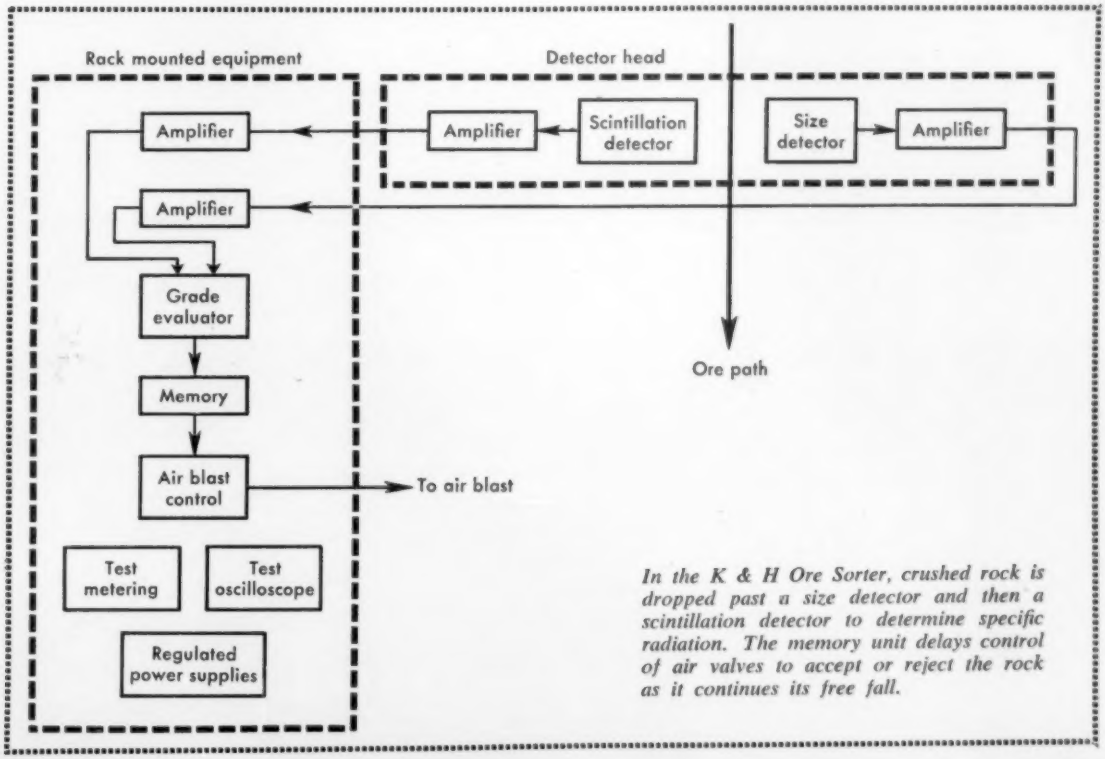
Bicroft Uranium Mines Ltd., Bancroft, Ontario, carried out a series of tests in 1958, prior to installation of the first K & H Electronic Ore Sorter.

At that time, Bicroft milled 1,400 tons of pegmatitic uranium ore per day, with grade running 0.1% U_3O_8. The ore contained both uraninite and uranothorite, and occurred as rich zones, lenses and tongues within irregular bodies of syenite and granite pegmatite of a much lower grade.

Rock by rock value distribution tests showed that after primary crushing, the + 2 inch size range was separable into the following fractions.

Assay Group	% by Weight	Assay % U_3O_8
<02% U_3O_8	71.0	0.013
>02% U_3O_8	27.7	0.077
Washed fines	1.3	0.198

This indicated that the uranium value of this size range was concentrated in the adhering fines (dust and small particles which can be washed off the rock) and a small percentage of the rock pieces. The rest of the pieces, con-



In the K & H Ore Sorter, crushed rock is dropped past a size detector and then a scintillation detector to determine specific radiation. The memory unit delays control of air valves to accept or reject the rock as it continues its free fall.

stituting 71% by weight, contained so little uranium that they could be discarded as waste. It suggested that sorting could be carried out profitably in this size range to provide savings in milling costs.

Further tests confirmed that sufficient radiation counts could be obtained in 1/10 second from rocks in the + 2-in. size range to determine their grade in the range 0.01 to 0.02% U_3O_8. At the same time, a method of sorting was developed which is capable of rejecting a + 2-in. rock by an operation which is completed in 1/50 second.

How the K & H Electronic Ore Sorter works

The K & H Sorter uses a new type feeder and conveyor system to align the rock in a single row. As the rock drops off the end of the conveyor it passes a size detector and a scintillation detector to determine the specific radiation activity. The rock then passes air nozzles controlled by the detectors. If the rock is over the preset threshold it drops into one conveyor chute; if below the threshold, air from the nozzles blow it into a reject chute.

Screened + 2-in. material at Bicroft Mines is diverted from the crusher circuit ahead of the standard cone. The rock is washed, and the valuable fines returned by a small Aikens-type classifier to the fine ore belt. The clean rock is conveyed to a 3-ton surge bin in the sorter plant.

Rocks are discharged from the bin at a steady rate by a Jeffery or Syntron vibrating feeder onto a single line feeder. This device consists of a rotating cone and a stationary spiral rock-retaining rim. It serves to convert the line-abreast feed into a single row of rocks delivered onto the centre-line of a 16-in. conveyor belt, 6 feet long, traveling at 200 feet per minute.

The rock pieces fall off the end of the conveyor belt and accelerate at a constant rate due to gravity virtually regardless of size. This acceleration, while the succeeding piece of rock is still in contact with the belt, is sufficient to give the required separation between pieces at the monitoring stage, and eliminates the need for any spacing between successive rocks on the belt.

A thin steel plate, curved to the exact trajectory of an average rock, serves to guide the falling rocks in a stable manner past the crystal of a scintillation counter and a modulated light source. Information from these sources is compared electronically and a decision made as to whether the rock is "ore" or "waste". This decision is then passed into one of several memory circuits to await the passage of the particular rock through the sorting stage lower in its fall.

The sorting mechanism at Bicroft Mines consists of three solenoid-operated two-way valves which use the 100-psi air supply from the mine. Three high-velocity nozzles spaced apart in a horizontal line are directed across the trajectory of the falling rocks.

If the rock is waste, a blast of air is ejected against it at the correct time to change its trajectory into the "waste" side of a splitter bin. If the rock is ore, it continues its normal trajectory in the ore side of the bin. Conveyor belts dispose of the rejected rock and pass the ore back to the crusher circuit.

The duration of the air blast is controlled by the size of the rock, whereas the decision to blast is determined on the basis of specific radiation. Rocks are acted upon with precise timing so that a large rock, which requires a greater force to move it across the splitter plate, is subjected to the air blast for a longer interval.

Operating capacity of the sorter will be determined by such things as the spacing of the rocks on the conveyor, the size range and percentage distribution of sizes within that range. The sorter at Bicroft Mines averages between 25 and 30 tons per hour.

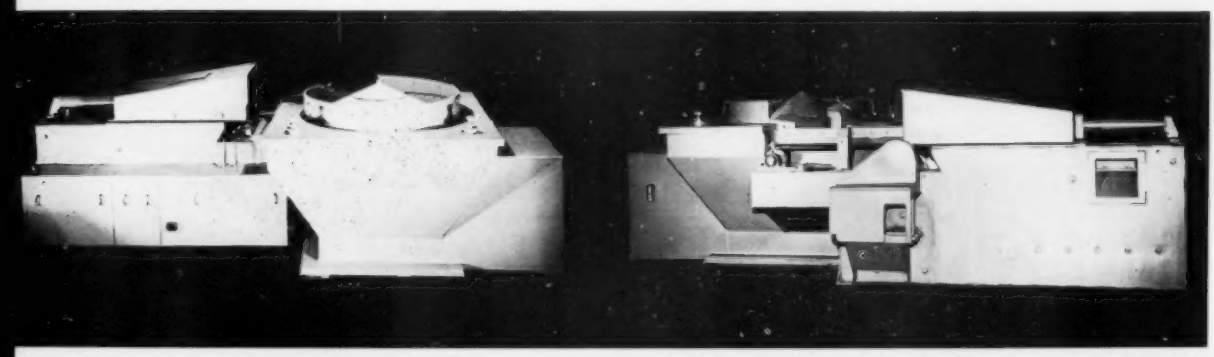
The sorter has been designed for fail-safe operation where all the rock is returned to the crushing plant the equipment fails. The electronic portion of the sorter was developed by Electronic Associates Limited, Toronto, and makes full use of modular construction to facilitate field servicing.

The air valves were developed by K & H Equipment Limited to provide a service life in excess of 20 million cycles at rates as high as 60 cps. They can be serviced by replacing inexpensive valve seats and "O" rings.

Extending the range of applications

Recent work has been carried out to extend the areas of operation of the K & H Ore Sorter. Photometric sorting can be used where the valuable mineral is associated with specific rock types. An example is gold ore in which it is desired to separate quartz and altered wall rock from waste rock. The separation is usually made on the basis of reflectance, color or ultra-violet fluorescence, rather than on radiation activity as in the case of uranium.

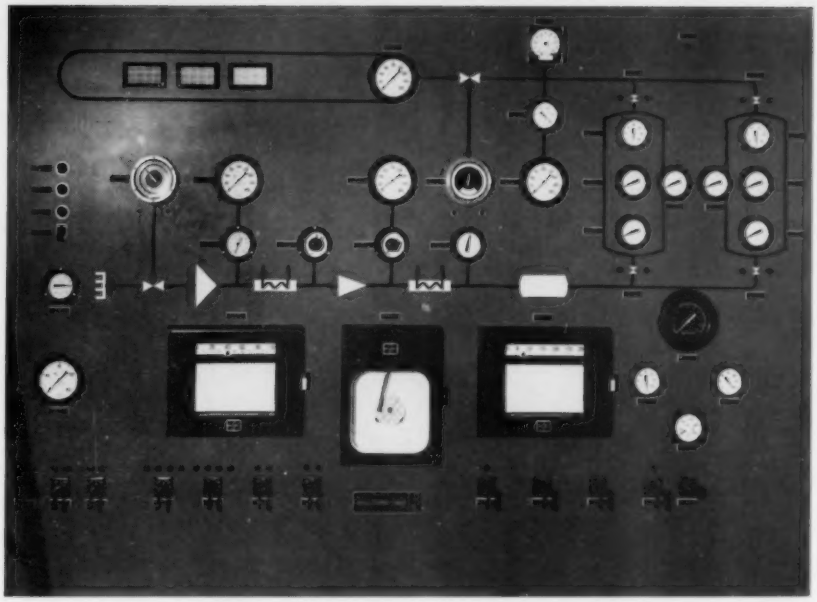
However, the economic considerations for installation of photometric ore sorting equipment will be much the same as outlined earlier in this article. Before mine owners can make any true decision about sorting equipment, or any other equipment, they must have detailed knowledge about all phases of their operation. END



These two views of a radiometric sorter show the rotating cone and stationary spiral rock-retaining rim used to align the rock before it falls past the detecting head. In the above view, the detecting head is at the right, protected by 6 tons of lead shielding to avoid background radiation interference. Unit is about ten feet long.

IAN R. DUTTON,
ASSOCIATE EDITOR

Do not oversell electronic equipment



Since the end of World War II the electronics industry has undergone a remarkable development, both in terms of productive capacity and technology. Almost every other industry found some way of using electronics to better itself in terms of reduced production costs, improved products, or products not possible without electronics.

But while the industry was booming and expanding, it was also setting up some of its future problems. That future is now the present.

Some aspects of electronics have been oversold, not only among our prospective customers, but also among our own technical people. Too often, engineers trained in electronics fail to recognize the virtues of other technologies such as hydraulics and pneumatics, or the limitations of electronics. Only by keeping them in their correct perspective will the electronics industry be able to build up successful long-term relations with customers.

The editors of CEE discussed the situation with people in various branches of industry to find their reaction. It must be recognized that our customers are subject to bias too, but here are some significant points and personal views that came out of the talks.

The electronics industry appears to be engaging in a tremendous sales campaign to create new markets. Part of this claim is quite true; we have lost markets for military and entertainment products, leaving the industrial electronics field as one of the major areas for prospective sales. Part of the reaction may arise from the large volume of literature from our industry, a natural consequence of rapid advances in product design and techniques.

However, a few specific examples were quoted to the editors of CEE, of electronics equipment installed where it was not really needed. It was not possible to determine whether the "overselling" was done by the manufacturer or the customer, but you may be sure the blame will ultimately come back to the manufacturer.

There are some functions which electronic equipment can perform much better than any other type of equipment. Detecting and measuring are two of them, and now we can almost claim that anticipating is a third such function. Electronic equipment can be very sensitive and operate with rapid response time, but it isn't every industry which needs such features. The chemical industry, for instance, can operate quite successfully with slow response time in its instruments, but it frequently needs large amounts of power.

This is where electronics is inferior to hydraulics or pneumatics. High-power electronic and electrical systems become bulky and expensive. Many of the newer pieces of equipment combine the best features of two or more basic systems. An example is a servo-driven hydraulic or pneumatic valve.

Many plants have hydraulic or pneumatic supplies available to them, making the purchase of additional compatible equipment quite attractive from the cost point of view. Also, servicing presents fewer problems on mechanical equipment than on electronic equipment for most companies. This subject has been discussed in the first two articles in this issue.

Customers using electronic instruments are annoyed by failure of our industry to standardize on signal requirements. At present there are four main standards in use. Manufacturers of pneumatic equipment eliminated the barrier by establishing a single set of standards for their equipment.

Computers for process control have opened a promising field for electronics manufacturers. It may have looked a bit too promising for some, judging from the number of new companies now manufacturing equipment. As mentioned earlier, this could lead to excess sales pressure and the installation of equipment where it is not justified. But if the manufacturers can avoid such mistakes they could end up with a healthy market because the use of special-purpose computers will grow and tend to create sales for other equipment compatible with them.

Even in this area, however, pneumatic equipment may be able to do some work better than electronics. Quite a bit of development is going into pneumatic computers for use in hot-gas environments. It may be that equipment of that type can be produced to function better than electronics under special conditions. In that event, our industry would only damage its long-range prospects by trying to sell less suitable equipment. END

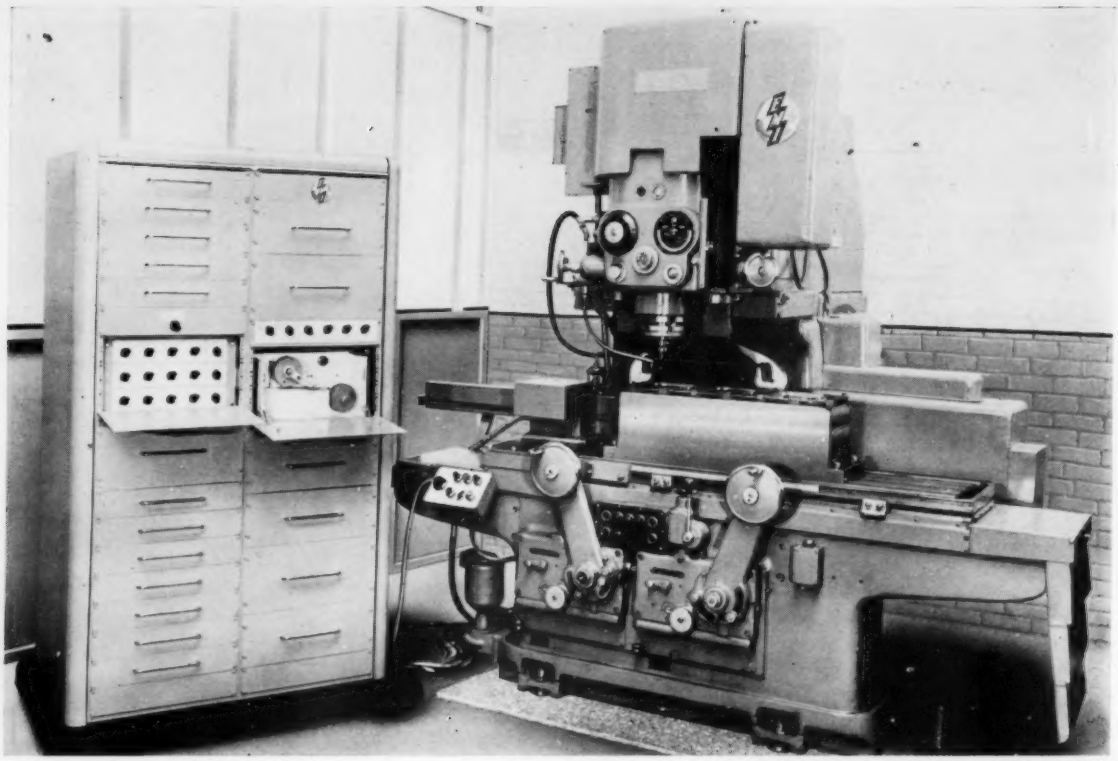


Photo courtesy E.M.I.-Cossor Electronics Ltd.

Problems facing users of industrial electronic equipment

HAROLD PRICE, EDITOR

Mr. Eric Leaver has dealt with the problems faced by the manufacturers of industrial electronic equipment in Canada, some of which he attributes to the users of this kind of equipment. This article attempts to show the users' side of the picture, based on interviews by CEE's editors.

All users and potential users of industrial electronic equipment have one problem in common: they wish to produce the highest quality goods or services at the lowest possible price.

The first step, therefore, in establishing whether the procurement of control or instrumentation equipment is justified generally consists of weighing the cost of the equipment against the benefits to be derived. The evaluation of the benefits is often a lengthy business, closely related to the economics of the process itself, as has been shown in the electronic ore sorter example on pages 34 to 36. The cost of the equipment includes not only the purchase price of its various elements, but also its installation cost and commitments for the future such as maintenance, operator training, etc.

A wide variety of benefits may result from the application of a control system to an industrial process, but probably only a few of these will be relevant to any specific case. They include: increased output, improved yield, greater utilization of labor force, improved quality, reduced services, prolonged equipment life, reduced maintenance, reduced down-time, replacement of more expensive equipment in a new design, and achievement of a process or result not otherwise obtainable.

It is, therefore, essential that equipment manufacturers take the trouble to become thoroughly acquainted with all the parameters of the processes to which they hope their equipment will be applied. Where the user has his own team of instrumentation specialists who can produce a set of specifications for the guidance of the manufacturer, this problem is considerably simplified. Unfortunately this is generally only the case in major industries such as steel, chemicals, and petroleum.

In many smaller companies, however, electronic apparatus is often looked upon with a great deal of suspicion, being new in all its problems of concept, application and

maintenance. Because it may contain tubes, it is often considered just another version of a radio or television set, in which years of high volume production and price cutting have devalued engineering and production achievement almost to the point of contempt.

Hence, electronic equipment is often thought of as a cheap bag of tricks, readily obtainable from a cut-rate store. But many companies have had unfortunate experiences arising from purchasing "off-the-shelf" instruments at attractive prices and then finding that they would not perform satisfactorily the function for which they were intended. As parts are readily available, and there are so many "experts," other plants have wasted thousands of dollars "saving money" by building their own electronic equipment without adequate personnel or facilities.

Some manufacturers, too, have aggravated this problem by developing an instrument or piece of equipment for one application and then extrapolating its use to different applications in their sales approach. A classic example of this is a complex data-logging equipment that is just lying idle because it has been found that the data it produces is not available in a readily analysable form. One way in which this problem can be overcome is for manufacturers to put potential users in the picture during the development stage of a new equipment, by inviting the users to their laboratories for full discussions of the equipment's possibilities and the user's needs. This would help considerably to avoid the situation where the equipment is marketed too quickly and gets a bad reputation as a result.

Environmental conditions

Apart from expecting that electronic equipment will improve the parameters of his production process in some way, the customer expects the equipment to operate reliably in the particular environmental conditions that prevail in his plant. Again, it is the responsibility of the manufacturer to familiarize himself with the range of temperature, humidity, vibration, shock, noise, power supply variations, and possible mishandling that apply in each case. These are frequently so extreme that standard components and instruments will not suffice, with the result that much of the equipment industry is prepared to accept has to be custom designed.

The effects of the particularly adverse environmental conditions that prevail in some plants have led to tube failures on such a scale that the plant engineers have developed a basic distrust of electron tubes in any application. Transistors are also regarded with similar suspicion in many plants, although some engineers suggest that they are satisfactory when used in the switching mode rather than as linear amplifiers. Equipment manufacturers therefore have a big selling job to do, based on sound circuit design, proper selection of quality components, and the use of voltage regulators where necessary.

The matter of supply voltage variations becomes even more critical when the fluctuations are of a duration shorter than the response time of the electronic equipment. Malfunction in control systems and errors in data processing can often be traced to this source. In addition, transient voltages caused by load changes can be injurious to sensitive circuit components, particularly semiconductors.

Reliability

Where the prejudices mentioned above do exist, they usually arise from the user having been frustrated in one of his most vital requirements — reliability. This becomes dramatically important when the failure of one component in a control system can force the shutdown of plant worth millions of dollars.

This problem grows as industrial control equipment becomes more complex. For example, in a computer used for business or engineering purposes, routine maintenance can be done at pre-scheduled times. A failure of equipment may be an annoyance but aside from delaying computation and possibly requiring the re-run of the program in progress at the time of failure, no harm results. But if digital equipment is to be used for control purposes, much more stringent requirements must be met. If the process is operating 24 hours a day, seven days a week without shutdown for long periods, so must the computer. Computing equipment must therefore be specially designed for industrial process control, with static devices throughout and components used at only a fraction of their rating to achieve reliability of the highest order.

This sort of consideration must be applied to some extent in the design of every piece of industrial electronic equipment if users' needs are to be met and the electronics industry wishes to see its market grow in this area.

Maintainability

Many manufacturers have demonstrated great success in their efforts to meet industry's need for reliable equipment. But no instrument or control can be 100% reliable and we have to recognize the cold truth that if an equipment can fail, it will. The industrial user takes this attitude: "If you can't make an equipment last forever, at least design it so that we can keep it going as long as possible, so that we can repair it in a hurry when we need to — with the men and the tools available."

Even when it is intended to perform complex tasks, electronic equipment should be made as simple as possible. Designers must remember that the man who has to repair the equipment, usually a man with no engineering degree, may have to work in bitter cold (with gloves), in sweltering heat (with sweat), or even in storm-drenched mud. And it may have to cope with bored, curious, intelligent man who wants to take it apart to see how it works — confident that the "tuning-up" he gives it will improve its operation and relieve a dull afternoon.

The road to maintainable equipment is, however, not a smooth one. There are times when maintainability features must be traded off for greater reliability, and there are many features which enhance maintainability but degrade reliability. Plug-in modules, for example, may defeat their own purpose if the plugs and socket connections are less reliable than the modules themselves.

Instruction manuals

Despite the tremendous growth in technical writing facilities in the electronics industry in recent years, largely arising from the needs of the armed services, many manufacturers still fail to provide adequate instructions for the installation, operation, maintenance and repair of their industrial equipment. In some cases, complex equipment has been shipped without any instruction manuals.

This represents extreme short-sightedness on the part of the manufacturer. A customer, particularly if his operation is large enough to include a competent engineering department, can get along without the use of an instruction book. But it's going to cost him a great deal of extra time learning how to operate and service the new equipment.

He may also damage the equipment accidentally, leading to costly repairs. If he encounters unjustified expense his comments to others in his field will not enhance the manufacturer's reputation, and although his lost-time expenses may be somewhat hidden, his repair bills will probably end up as a warranty service charge against the manufacturer. The customary excuse given for poor books is high cost — but customers are not interested in buying excuses. END

Self-adapting controls will extend range of industrial automation

Considerable attention is being devoted in many laboratories to the study of self-adapting control sytems, spurred by parallel developments and industry's needs. This article indicates how self-adapting systems differ from conventional controls, discusses the inclusion of learning capability, and shows why their development is so important.

Perhaps the most exciting prospect on the horizon of control system technology, and hence of automation in general, is the possibility of building automatic control systems which incorporate self-adapting characteristics. For the purpose of this article the terms "self-organizing" and "self-adapting" systems will be regarded as synonymous.

Systems which incorporate a self-adapting capability will normally possess the property of learning through association, in much the same way as Pavlov's dogs learned through association and became conditioned. A convenient description of advanced forms of adaptive systems is that they are systems which can modify automatically their own structure (in the more elementary cases the modifications may merely consist of changes in the values of control parameters) by a learning process, in order to optimize system performance.

Considerable attention is being devoted in many laboratories to the study of self-adapting control systems. Already elementary forms of such systems have been built and used, for example, in missile control systems, and it is not improbable that their application will be widespread in industry within the next decade or two. It is already recognized that the new concepts involved open up important possibilities in the control of highly complex processes, and perhaps also possibilities relating to the understanding of biological mechanisms in which learning is a fundamental characteristic.

The greatly increased interest during the past few years in self-adaptive control systems probably stems from the following four basic reasons:—

(i) Self-adaptation constitutes an obvious step in the natural evolution of automatic control systems and parallels similar evolution in the biological world.

(ii) A degree of excellence in the design of servomechanisms and automatic regulators has now been achieved which forms a solid foundation for the growth of the subject, and self-adaptation may be regarded essentially as the result of more profound exploration of control system principles, as a whole, with the advent of new concepts.

(iii) A host of extremely difficult problems have arisen during the past two or three years which call for the capability, on the part of the control system, to adjust its parameters or structure to deal with a non-static environment. A notable example arises in the instrumentation of space rockets.

(iv) In parallel with the more advanced concepts, of which self-adaptation is perhaps the most fundamental, considerable advances have been made in computing techniques, both analog and digital, and not least in the considerably improved reliability of the semiconductor devices used in these systems. This suggests that the industrial application of self-adaptive control systems should not be unduly delayed because of lack of reliability.

The main purpose of this article is to indicate how these systems differ from conventional control systems and to indicate also, in a general way, why the development is considered to be so important.

Evolution of control systems

In order to put the subject into its proper perspective it may not be out of place to consider briefly the way in which automatic control has evolved and to show that self-adaptive systems are by no means new in principle. Indeed it would not be a wrongful interpretation to regard all feedback control systems as self-adaptive in nature. The important point is that different degrees of self-adaptation must be recognized. The most elementary of these are the simple protective systems, the simple servomechanisms and automatic regulators whose use is widespread in industry, and in all the affairs of man. We shall see that the degree of self-adaptation inherent in a system may be associated with the degree of determination of system behaviour. In other words, if we can predict successfully the future behaviour of a system there is a low degree of self-adaptation required in the system; on the other hand, when it is difficult to predict the future behaviour of the system there may be a high degree of self-adaptation required. And we shall also see that protective operations may be regarded as possessing the lowest degree of self-adaptation, and that optimization will normally require the highest degree of self-adaptation.

As explained subsequently, certain elementary protection and regulation processes may be described as "self-adaptive" even though no learning mechanism is involved.

Several authors recently have classified self-adaptive systems, and, in particular, Aseltine[1] et al have suggested five basic classifications. However, these classifications do not recognize the degree of self-adaptation involved; this is attempted in the following list of developments which exemplify the evolution of self-adaptation as a control technique. It should be noted, moreover, that only the final three items in the list may be regarded as being truly self-adaptive in the sense that they are the only ones which incorporate learning capability as a basic requirement. On the other hand, the systems described in items (i) to (v) below are nevertheless self-adaptive to varying degrees, and it is important to understand the principles involved in their operation before attempting to understand the more advanced ideas.

In my view, therefore, the following properties of automatic control systems constitute an evolutionary sequence of developments which lead logically to self-adaptation with learning.

Self-adapting systems which do not include learning

(i) The most basic class of systems, which may be regarded as incorporating self-adaptive behaviour, are those which possess inherently the property of self-regulation. Probably the first study of the effects of self-regula-

tion in the automatic control of processes was made in 1935, and some of this fundamental work in automatic control is sometimes overlooked by modern writers[2]. Analogous to self-regulation in physical systems is the inherent "protective" mechanism built into biological systems. For example, "eye blink" of the new born child may not be a conditional reflex but rather an inherent protective device which was already programmed at birth.

(ii) In the control of many processes the basic step is to build into the system a series of protective devices which ensure "fail-safe" operation when undesirable conditions arise in the operation of the process. These protective systems may be regarded as completely programmed and they certainly provide the system or plant with a measure of self-adaptability. Moreover, unless such protective devices are incorporated into control systems it is quite impracticable to introduce self-regulatory systems and, perhaps, subsequently self-adaptive systems incorporating learning capabilities. I regard such protective devices as the pre-requisite to conditioning processes and I believe that this also applies in biological systems, on the operation of which I believe we must base the design of our more advanced automatic control systems. In protective systems of this class very little information, as such, is involved, and the degree of quantization may be regarded as very coarse (for example, protective devices normally only operate when the value of a significant variable is perhaps greater than a given value, or when a set of variables exceed certain desired values).

(iii) Communications and control systems which incorporate automatic gain control (AGC) may be classified as simple self-adapting systems. For example, in many communication systems the signal strength is continually monitored and a subsidiary control loop maintains it at a desired value. In the case of certain servomechanisms and automatic regulators the gain of the amplifier in the main control loop is sometimes dependent on a particular characteristic of the system behaviour, and steps are taken to compensate the amplifier gain accordingly. Since the amplifier gain is an important parameter in control system design and since, in systems embodying automatic gain control, the gain of the amplifier is compensated in accordance with changes in the environment, it is clear that this class of system possesses a self-adapting property, although learning is not involved. Indeed, although less deterministic than normal protective systems, devices incorporating AGC may nevertheless be regarded as programmed.

(iv) Servomechanisms which incorporate an "input-signal modification process", in which the input signal is modified to compensate for basic shortcomings in the control system, also may be regarded as self-adapting. For example, in certain hydraulic control systems there is an inherent velocity-lag and it is possible by adding a velocity component to the input signal to compensate for this inherent error. The so-called "conditional feedback" systems of Land and Ham[3], which incorporate system "models", constitute a generalized form of this class. And, in the case of automatic regulators, Reswick[4] has used a similar "model" approach, called "disturbance-response feedback", which is fundamentally similar to the Lang-Ham system. Moreover, theoretically, the method can be extended in such a way that the operation of the process itself leads to the automatic development of a system model which in turn acts as the major control device.

(v) Regulating systems in which the major disturbances which affect the system can be monitored and the "disturbance signal" combined with the main regulation loop error signal may also be regarded as a special form of self-adaptive control systems. A typical system of this class was studied by the author[5] in 1947. In principle the technique does not differ appreciably from the ideas introduced later by Lang and Ham, and by Reswick.

Self-adapting systems which also include learning

(i) The classes of self-adapting systems considered above do not possess a learning capability. One of the first systems to be described which incorporates a learning capability is the "learning filter" developed by Gabor et al[6]. Given a noise-free signal and the corresponding signal with noise superimposed, the Gabor machine is capable of adjusting the parameters of a non-linear filter in such a way that the "noisy" signal can be filtered to give a good approximation to the "noise-free" signal. Essentially this system learns, through a process of successive approximation, the characterists of the stochastic signal, and, utilizing the principle of minimizing the root-mean-square error, the optimum values of the filter parameters are obtained. This is a truly self-adapting learning process. The same technique could also be applied to a self-adapting servomechanism or automatic regulator.

(ii) Another potentially important class of self-adapting systems is that which may be regarded as being based on the Conditional Probability Computer[7]. In processes which involve two or more control variables the problem of self-adaptation become more difficult because of interaction between the variables, and it is necessary to rely completely upon a probabilistic approach to the problem. The object of the Conditional Probability Computer is to determine the basic probability patterns which arise in the operation of the system, and to use these patterns to modify the values of the control parameters in order to produce optimization or, perhaps subsequently, to use these patterns to reorganize the structure of the control system as such. These possibilities are discussed in some detail elsewhere[8].

(iii) In general we may regard the goal of a self-adaptive system as being the conditioning of a system to deal automatically with a particular class of environment. Indeed, this is the modus operandi of elementary self-adapting systems in biology — these systems eventually may become "conditioned reflexes". However, having conditioned a process at one level, it can be expected that the next stage will be to apply self-adaptive principles to achieve conditioning at a higher "decision-taking" level. I believe that in many biological systems the process of conditioning is essentially progressive, and may be considered as a hierarchy of conditioned responses. System behaviour is never static and continually seeks to achieve a higher

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Self-adapting controls

level of conditioning. Similarly, I anticipate that the design of self-adapting control systems in the future will be based on similar goal-seeking procedures in which the goals are higher levels of conditioning. With continually changing environments it is clear that such systems will never reach a steady-state except in the very idealized case of ergodic stochastic environments.

Clearly, because of the nature of the development of self-adapting control systems, ranging from the crudest form of protection system to a hierarchy of conditioned processes of increasing complexity, it will only be possible to consider briefly the fundamental "organs" which are essential in self-adapting control systems with a learning capability.

Basic organs of self-adaptive control

Perhaps the most basic component in a self-adapting system is that which determines, through a process of association, the basic patterns of behaviour involved in the system. In the more elementary cases it may be possible to build up a probability matrix, which describes the probability that a given response will be obtained when a given stimulus is applied. Such a probability matrix can be represented as shown below:

		P	Q	R	S	Response
	A	0.0	0.9	0.1	0.0	
	B	1.0	0.0	0.0	0.0	
	C	0.1	0.1	0.8	0.0	
Stimulus	**D**	0.0	0.0	0.0	1.0	

For example, given a stimulus B the probability of a response P is 1.0; etc.

In the case of an ergodic stochastic process this probability matrix will eventually reach a steady-state and we say that the corresponding behaviour pattern has been established. At this stage it may be possible to establish a "programmed network" based on the probability matrix and then the process may be regarded as "conditioned".

Accordingly, learning will ultimately lead to conditioning if practised for a sufficiently long time and if the environment is truly ergodic.

But, in establishing the patterns of behavior it is necessary to include the idea of "goals" because otherwise it would be impossible to discriminate between satisfactory and unsatisfactory behaviour. If appropriate goals, which usually may be regarded as constraints on the system, have been introduced, the means of discriminating between satisfactory and unsatisfactory behaviour is to determine the extent to which new information fits into the behaviour patterns which have been established. Experiments which yield unsatisfactory behaviour must nevertheless not be discarded, however unsatisfactory, because they may constitute evidence of a legitimate occurrence, which might arise, for example, as a result of a sudden change in the environment. Note, however, that the more highly conditioned the system, assuming an ergodic stochastic environment, the less the likelihood, in general, of the system attributing much weight to unusual information. On the other hand, even in cases where the ergodicity of the system is apparently beyond "reproach", the repeated occurrence of unusual information which provides reinforcing evidence that something is wrong, must not be overlooked by the system. For example, such evidence may provide a means of locating a fault which has developed in the control system.

In the case of continuous information (e.g. analog information) the usual method of establishing patterns is to obtain the auto-and cross-correlation functions of the appropriate information, and thereby to ascertain system dependencies. The more random the environment the more difficult it is to obtain such dependencies in spite of the fact that the system may still be regarded as stationary in time. And accordingly the patterns will normally be less well defined. In the case of the Gabor learning filter[6], for example, a large number of individual "passes" of the information through the machine would be required before the approximately "noise-free" signal is obtained.

In systems in which the information is available in digital, or quantized form, the corresponding correlation functions may be obtained by means of such a machine as the Conditional Probability Computer. In the most elementary cases the information is available in the form of binary signals and in this special case the Conditional Probability Computer may be as described by Uttley[7]. Before patterns of behaviour can be established it is necessary, in all cases, to introduce the goals in a practical form and in some cases this may present serious difficulties. This problem is discussed briefly in a recent paper[8].

When we consider the problem of higher-level conditioning it is likely that the complexity of the patterns will increase with the level of conditioning, and it is therefore most important in the design of complex control systems to ensure that low-order patterns are established initially before tackling the much more complicated higher-level patterns. In this connection "low-order" might mean "coarse" in the sense of coarse quantization (e.g. two-level). Subsequent conditioning processes will no doubt include "fine" information and accordingly more complex behaviour patterns.

It is also important to note that, except in trivial cases, the process of self-adaptation leading to conditioning cannot be instantaneous because time is taken to establish the patterns. And the learning process so involved can be regarded as an evolutionary process in an analogous way to the evolution of biological species.

An essential component in a self-adaptive control system with learning capability is the "random search unit". The significance of this unit is discussed in some detail elsewhere. Suffice it to add that the random generator initiates the "experiments" which in turn provide information for establishing the behaviour patterns. All self-adapting systems with a learning capability must incorporate such a random generator in order to optimize the search procedure (i.e. the search for more effective system optimization or alternatively for a higher order of conditioning).

To sum up, the basic requirements for self-adapting systems with learning capability are:

(i) An analyzer, or Conditional Probability Computer, capable of determining the significant correlation functions in the behaviour of the process. This analyzer must inevitably incorporate a memory system.

(ii) The process goals must be ascertained and introduced into the control system in a form which the machine can "understand".

(iii) The system must incorporate a random search unit which is capable of carrying out search procedures (utilizing randomly selected values of control parameters) for the establishment of probability behaviour patterns.

(iv) Weighting functions associated with the pattern determinations must be built into the system, although

perhaps in more advanced systems the actual weighting of information may be carried out automatically and the optimum weighting functions determined automatically.

(v) All available information must be utilized in the design of the system, and fundamental protective systems and perhaps crude conditioning and regulating processes must be incorporated, before the learning capability of the machine is brought into operation. Prediction must be the fundamental operation and this will be based upon the ability of the system to recognize patterns of behaviour.

Future prospects

Only comparatively crude self-adapting systems with limited learning capability have been developed up to the present. But the fundamental requirements of such systems have been fairly well explored, and it is not improbable that within the next few years processes involving as many as five or six basic control parameters may be optimized using the self-adapting approach.

The use of biological models to provide guidance in the design of self-adapting systems, which eventually lead to conditioned behaviour, is becoming more important, not only in the field of automatic control, but also in the whole field of educational philosophy. In the investigation of self-adapting control systems, for example, we will study the conditioned reflexes of the body, while in the investigation of educational problems we will study the conditioning of the mind.

END

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Pollock urges government action to assist Canadian industry

Agreement by government, industry, and labor on a "hold-the-line" policy for wages and prices was proposed last month as a major requirement if the Canadian economy is to advance and prosper.

Speaking to the Rotary Club of London, Ontario, Carl Pollock, president of Dominion Electrohome Industries Limited, admitted that the plan would be unpopular with unions and government but is necessary if Canadian industry is to increase its sales in Canada, and abroad, and provide more employment for Canadians.

In a four-point plan, which he suggested be considered by the proposed Government Productivity Council, Mr. Pollock also suggested:

- That the government give incentive, through tax adjustments, for research by Canadian companies, exports, and Canadian ownership of Canadian businesses. He suggested that Canadian companies be allowed to deduct $1.50 before taxes for every dollar spent on research. Such an incentive would cause many U. S. companies to spend their research money in Canada, he said, and would halt the loss of research personnel to the United States.
- That protective tariffs be established, especially with countries which have a favorable trading balance with Canada, so as to allow competition for Canadian industry without putting Canadian industry out of business.
- That Canadian business preach the value of the profit system, and teach the values of the system by setting up profit incentive schemes among its own employees.

"Profit to most people is a dirty word," said Mr. Pollock. "The men who are able to achieve a profit in business are not nineteenth century robber barons. They are actually the benefactors of society."

Mr. Pollock claimed that too many of Canada's economic problems are approached with the idea of putting out a fire or taking an aspirin, whereas national objectives and purposes are required.

"We have to do what is best on a long term basis," he said. "Last week's speech from the Throne gave promise of a number of things, but only the session itself will tell if the necessary action will occur."

Panel members A. J. Capstick and S. Finlayson listen as moderator A. Oxley sums up results of discussion on imports.

Montreal meetings attract engineers to discuss communications

Montreal, a communications centre of major importance, was the site of two meetings early last month. The Montreal Section of the Institute of Radio Engineers sponsored the IRE Symposium on Communications. Two days earlier, Automatic Electric Sales (Canada) Ltd. held a Light-Route and Mobile Radio Seminar.

A highlight of the IRE Symposium was a panel discussion on Canada's import problems. Mr. S. Finlayson, president of Canadian Marconi Company started the discussion with an account of his trips to Hong Kong and Japan.

In almost all parts of the world outside North America and Western Europe people are hungry and willing to work hard for their food. Mr. Finlayson thinks we must lower our material standards a bit if we are to resist this great pressure. Canada is the fourth largest trading nation in the world and we must be prepared to engage actively in both imports and exports, even though our exports are lower than imports at the present time. The Canadian electronics industry must take off its blinkers, undertake a severe self-analysis and improve manufacturing efficiency.

Mr. A. J. Capstick, general manager of Pye Canada Ltd., pointed out that there were two kinds of importing operation in Canada. One type was a straight commercial operation with no Canadian labor and little benefit to the customer in the long run. The other type of importing could be used to build a healthy Canadian industry, ultimately with its own manufacturing and engineering operation. Mr. Capstick felt that the government could help the Canadian electronics industry by creating a favorable atmosphere. This would include a long range policy on defence to allow industry to establish plans, provide credit and tax incentives, and offer guidance in labor relations.

After a lively discussion from members of the audience, panel members summed up the situation by stating that the Canadian electronics industry would have to improve its operating efficiency, engage in research and development (possibly in co-operation with the government), and go after exports in those specialized fields in which Canada can compete effectively.

The next fifty years of IRE

Speaking at the luncheon, Dr. R. L. McFarlan, president of IRE, outlined some of the problems facing the institute. The rapid growth of IRE (approximately 8,000 new members per year) and its international character present interesting management challenges. In addition, there are technological changes to consider.

The only safe prediction to make, said Dr. McFarlan, was that IRE would remain flexible so it could adapt itself to changing conditions, internally and externally, to provide the best service it could to its members.

Automatic Electric Seminar

Fifty engineers representing equipment manufacturers, telephone operating companies, common carriers, and public utilities met in Montreal November 2 and 3 to discuss the planning, system engineering and reliability of light-route and mobile radio in Canada. Expert speakers dealt with the various aspects of the subject individually and in panel discussions. This was the third such seminar sponsored by Automatic Electric Sales (Canada) Ltd. The program will be repeated in Edmonton next April.

Three busy people at the IRE Symposium were E. P. Turton, left, general chairman; Mrs. Wallace, chairman, ladies activities and R. Wallace, chairman, Montreal Section.

Dr. R. L. McFarlan, president of IRE, right, acting on behalf of Montreal Section, presented a pen set to A. B. Oxley "For Recognition of Services to IRE in Canada".

Exhibitors displayed a good selection of new equipment. G. McCurdy was kept busy showing audio control consoles.

J. Keane, left, of Needco Cooling Semiconductors Ltd. explaining new thermoelectric cooler to H. J. Morrison.

Three of the participants in the Automatic Electric symposium were D. Loftus and W. J. Wilson, Dept of Transport, and J. Naugle, Lenkurt Electric Co., Inc.

Panel on light-route radio: S. Bonneville, Bell Tel.; D. Talley, GT&E Service Corp.; T. Cushing, Lenkurt; C. Bridgeland, C.N. Tels.; E. Collier, C.G.E. END

CANADIAN ELECTRONICS ENGINEERING

Index of editorial features Volume 4 1960

Classifications used in this index correspond to the Professional Groups of the Institute of Radio Engineers. Articles are arranged alphabetically under each classification.

For your library

Text introduces electro- and magneto-strictive systems

Solid State Magnetic and Dielectric Devices

Harold W. Katz, Editor; John Wiley & Sons, Inc., New York; 542 pp; $13.50

Reviewed by R. S. C. Cobbold, Department of Electrical Engineering, University of Saskatchewan.

This book is primarily concerned with the theory and application of nonlinear magnetic and dielectric materials and contains the contributions of some fourteen experts.

One of the major problems confronting the editor of such a volume is that of integrating the individual contributions and ensuring that there is no excessive repetition. Dr. Katz, the editor of this volume, has done a remarkable job in this respect; he has both ensured that the material is logically developed, and has made an excellent job of unifying the various theoretical and practical aspects of magnetic and dielectric devices.

The book begins with two introductory chapters on Electro and Magnetostatics, and this is followed by a moderately advanced introduction to Electro and Magnetostrictive systems. Further chapters consider mainly the nonlinear behavior and applications of certain materials, ranging from ceramic filters to applications of thin films for high speed computer memories. It is not surprising that, in a book covering such diverse applications, the reviewer would prefer to see the discussion of some topics expanded, and others compressed; however, this criticism is largely offset by a good selection of references at the end of each chapter.

In the reviewer's opinion this volume fulfills an important need both as a text at the undergraduate/postgraduate level, and as a valuable addition to the circuit designer's bookshelf.

Thermoelectric Materials and Devices

I. B. Cadoff and E. Miller; Reinhold Publishing Corp., New York; 344 pp; $9.75

Reviewed by C. A. A. MacPhee, Research Laboratories, Needco Cooling Semiconductors Ltd., Montreal.

A book comprising a series of lectures designed to cover the field of thermoelectricity can be expected to be diverse and this is no exception. Theory, evaluation of materials, representative materials and principles of devices are all covered in 335 pages.

The book is useful as a source of information, since 13 of the 19 chapters give adequate and, in some cases, extensive references. Chapter 17 deserves special mention in that, although no references are given, an excellent series of nomograms for the solution of design equations for Peltier couples is given and its companion, chapter 16, on the design of power generators, should be commended.

Measurement of the properties of thermoelectric materials is treated unevenly. For example, chapter 8 is devoted to the measurement of thermal conductivity and the fact that no reasonably simple and accurate method is given underlines the difficulties involved. In contrast, the chapter devoted to the measurement of thermoelectric properties (chap. 6) is deceptively simple. The equipment required to perform the measurements outlined is expensive, complex and time-consuming to use, although capable of excellent results. No mention is made of the fact that many methods of measuring thermoelectric power, for instance, are described in the literature or that those which are accurate require special specimens and those which do not are inaccurate, often to the extent that they cannot be used with certainty. No mention of the measurement of ΔT max is made, although this measurement is fraught with pitfalls for the unwary. This measurement can provide much information in a short time and considerable effort has been devoted to devising simple and accurate methods in this writer's laboratories. Variants of this method can pinpoint faults in modules and it should not be forgotten that the demonstration of ΔT max is still the most convincing proof of the quality of materials used for cooling applications.

Many subjects are treated with varying emphasis, including some, such as the use of liquids and molten salts as thermoelectric materials, not found in other books. The chapters on thermal conductivity mechanism, the thermoelectric properties of refractory materials and on ionic materials are very informative.

In general, the book is not recommended to the uninitiated but it will find a secure place on the bookshelf of the serious worker in this field.

Algebras and Their Arithmetics

Leonard Eugene Dickson; Dover Publications, Inc., New York; 241 pp; $1.35

Reviewed by G. H. M. Thomas, Professor of Mathematics, Computer and Control Laboratory, University of Saskatchewan.

This is a reissue of a book which first appeared in 1923. It is a classic in its field although now somewhat superseded by later works.

The meaning of the title may be explained by an example. Consider the set of all 2 by 2 matrices $A = (a_{ij})$ whose elements are real numbers. There are three operations defined for such matrices; addition $A + B$, multiplication by a real number cA, and multiplication of two matrices A.B. These operations satisfy most of the usual laws including the associate law $A(BC) = (AB)C$ but not the commutative law of multiplication. An algebra over the field is a generalization of such a system.

It turns out that every algebra contains a subset of "integral elements." For example, the integral elements of the algebra of complex numbers $x + y_i$ are the numbers $a + b_i$, where a and b are integers.

This book has two main parts. First, the study of such algebras leads to many "structure theorems" showing how they are constructed from simpler subalgebras of special types. Second, the "arithmetic" of an algebra is the study of the many special properties of the integral elements. There is also a chapter on finite fields and congruences. These concepts have recently been useful in circuit theory.

It should be remembered, however, that this is a book originally written for mathematicians and not for electrical engineers. Hence there are no indications given of possible applications of the material.

Electronic Computers

This monthly publication from Germany is devoted to the technique and application of data processing equipment. Many of the articles deal with technical descriptions of new computing equipment, while others deal with applications. The publication was started in January 1959 and is published in German with some papers and abstracts in English. Price is 42 DM per year (approx. $10.00) from R. Oldenbourg Verlag, Munchen 8, Rosenheimer Strasse 145, Germany.

Canadian-designed cheque sorter delivered to bank in U.S.A.

Scooping its American competition by at least two months, Ferranti-Packard Electric Ltd. Toronto has delivered the first cheque sorting equipment to the New York Branch of the Federal Reserve Bank. Several sorters were ordered simultaneously from different manufacturers to be installed in branches of the bank for appraisal. The sorting system built around the Ferranti-Packard digital stored reference computer is believed to be the first installation in North America for fully automatic cheque collection-transit operation.

The Federal Reserve Bank will be conducting operational tests for at least six months, using the new Canadian computer for the sortation of their total of 2¼ million cheques per day at a rate more than thirty times faster than conventional equipment.

Document sorter shown in Canada

In a series of demonstrations in major Canadian cities, Burroughs Adding Machine of Canada Ltd. introduced its Type B-101 Magnetic Character Sorter. It can read characters printed with magnetic ink on cheques and other documents, and sort them at a rate of 1560 per minute.

The sorter is one unit of a complete Magnetic Ink Character Recognition (MICR) electronic banking system developed by Burroughs Corp. The ink can be read by either human eye or by machine, and is used to record the depositor's account number, bank name, branch and location.

The bank may purchase the coded cheques from a supplier who handles this type of printing, or can install a magnetic imprinter, or a magnetic amount and account number printer and do the coding on the premises.

By addition of conversion equipment, the sorter will fit into a completely automatic system which includes full scale electronic computers for cheque handling, proving, bookkeeping and preparation of customers' statements.

Last year 2,750,000 cheques were processed each banking day by Canadian banks. That represents a daily increase of 1,000,000 since 1949. The Sorter can handle the work at a rate 60 times faster than manual operation.

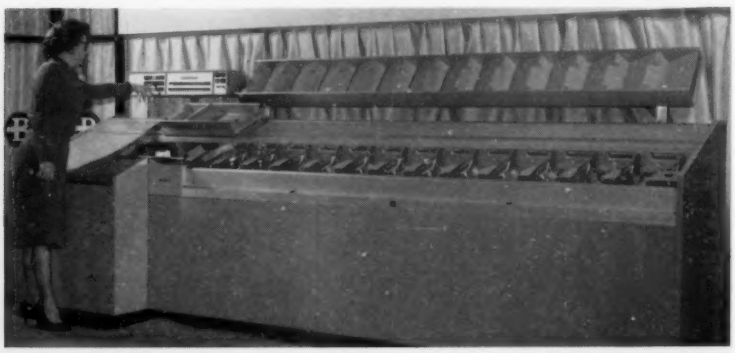
Instrument-automation conference

More than a dozen technical sessions have been scheduled by the Instrument Society of America for its Winter Instrument-Automation Conference & Exhibit, to be held in St. Louis, January 17-19, 1961. All Conference sessions will be held in the Sheraton-Jefferson Hotel. The exhibits will be held in Kiel Auditorium.

At least three of the sessions will be "firsts". These will be on biomedical instrumentation, cement and lime instrumentation, and a session under the auspices of the newly formed Measurement Standards Division of ISA, of which Orval L. Linebrink, Battelle Memorial Institute, has been named director.

The bulk of the papers being scheduled for the sessions reflect instrumentation in the process industries, among them, chemical and petroleum instrumentation, measurement and control instrumentation, and analysis instrumentation.

Papers scheduled for the biomedical sessions cover a wide field of instrumentation as used in medicine and space flight. Medical instrumentation of a space flight capsule will be discussed; also new developments on artificial intracorporeal heart pumps, instruments for metabolic studies on humans, and for optical density studies on biologic fluids.



Burroughs B-101 magnetic ink reader-sorter handles 1560 items per minute.

Automatic control papers wanted

The Second Joint Automatic Control Conference will be held on the University of Colorado campus, Boulder, Colo., June 28-30, 1961. It is sponsored jointly by IRE, ISA, AIChE, AIEE and ASME. Session categories are expected to include process dynamics; techniques of control system theory; adaptive control; new components; and systems testing.

A call for papers has been issued by Prof. H. M. Paynter, Mechanical Engineering Dept., Massachusetts Institute of Technology, the 1961 general program chairman. All authors are asked to send brief abstracts promptly, with a rough draft of the entire paper before the end of 1961. Abstracts and rough drafts are to be sent to the authors' representative society for consideration.

Program chairmen for IRE, ISA and AIEE are: IRE — R. Kramer, Electronic Systems Laboratory, MIT, Cambridge 39, Mass.; ISA — J. L. Harned, Research Laboratory, General Motors Corp., Warren, Mich.; AIEE — K. Chen, New Products Laboratory, Westinghouse Electric Corp., P.O. Box 10596, Pittsburgh 35, Pa.

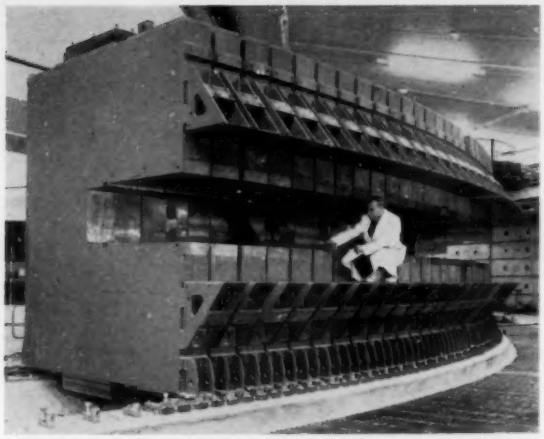
IAEA outlines 1961 program

The program of work for 1961 which the International Atomic Energy Agency's Board of Governors has presented to the Agency's General Conference for final approval provides for steady amplification of its work in technical assistance to specific projects, training of scientific personnel and scientific research.

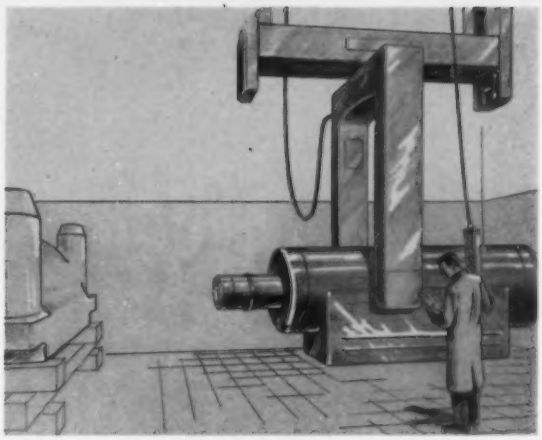
In connection with the Agency's supply functions, it is planned to convene in 1961 a conference on nuclear electronics.

With the growth in size and experience of its scientific staff the Agency will be in a position to render more scientific services with its own facilities. There will be an increase in its work in the field of nuclear instrumentation, as well as other projects.

It is planned to bring up to date the International Directory of Radioisotopes and Labelled Compounds and to publish a new edition. Scientific publications of the Agency will



This is part of a 7,000-ton magnet core for the 7 GeV proton synchrotron at the Rutherford High Energy Laboratory of the National Institute for Research in Nuclear Science, Harwell, England. The core, produced in 336 sectors, has a diameter of 160 feet.



Designed for high-speed radiography in the metals industry, this 8 MeV linear accelerator is being built by High Voltage Engineering Corp., Burlington, Mass. for A. O. Smith Corp., Milwaukee. It will produce 6,000 roentgens per minute with choice of 1 and 5 mm focal spot sizes.

be similar to those published in the preceding two years. They include the International Journal on Thermonuclear Fusion and Plasma Physics.

U.K. scientists develop new instruments

Research workers of the United Kingdom Atomic Energy Authority's Development and Engineering Group have built and are patenting a radiation pyrometer and associated electrical circuits capable of continuously measuring surface temperatures of metal bars in the range 650 to 750 deg. C, travelling at rates up to twenty feet per minute.

Measurement is effected in a narrow band (½ to ¾ in.) between a heating zone and a quenching zone. A heat radiation transmission path is provided by a fused quartz rod, the receiving end of which is shaped like a fish tail and partly encircles the bars. At its other end is a lead sulphide photocell.

The quartz rod has two breaks, the first for a rotary radiation chopper in the form of a slotted disc turning at a speed to give a chopping frequency of 1,000 counts per second, the second for a radiation chopper having alternate blades of perspex and germanium and giving a 10 counts per second frequency.

Furthermore, the rod transmits radiation over the wave-length interval from 0 to 2.5 microns, the perspex blades of the second radiation chopper from 0 to 2 microns and its germanium blades from 2 to 2.5 microns.

Thus, the lead sulphide cell receives alternate signals at 10 c/s on a 1,000 c/s carrier signal. The current from the cell is amplified and rectified and the two dc levels corresponding to the two wavelength intervals fed to a switch. The resulting signals are smoothed and transmitted to the slide wire and pointer of a potentiometer and presented to the ratio recorder of this device. The reading at the ratio recorder is a function only of the bar surface temperature.

Matching human and electronic systems

The Electrada Datacom is an electronic unit which provides a display and control link between the human operator and high speed data processing or communication systems.

Datacom accepts digital information at line speed, automatically translates it to ordinary alpha-numeric characters and presents a display on the screen of a cathode-ray tube. As the information is being displayed, the operator may approve its contents, or he may alter them in part or in total by striking a standard typewriter keyboard.

Both incoming and outgoing records are held in the display until the operator punches the send button, causing the unit to retranslate the information to coded form and transmit it automatically to the associated communications network or computer.

Display of incoming and outgoing data takes place in a high-brightness crt, the upper part of which shows the information or message, while the lower part displays the revised or approved version which is to be transmitted. A magnetic storage drum with a capacity of 3072 bits provides a display memory which stores the information for the upper and lower halves of the screen and holds them ready for editing or transmittal.

X-rays and tv aid vibration testing

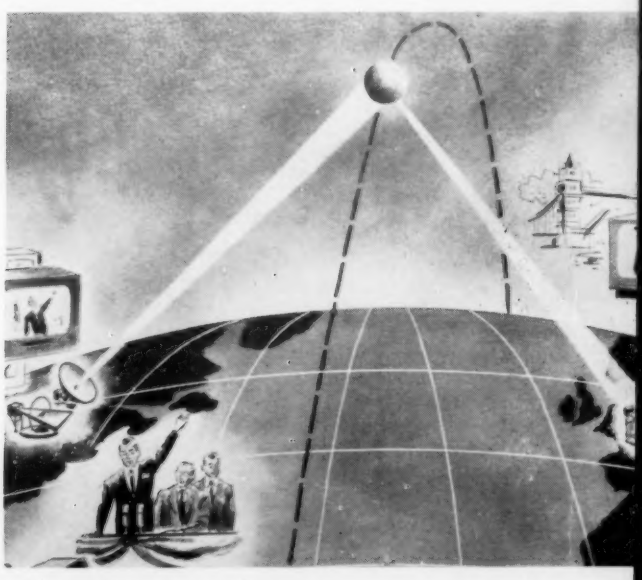
Television and high intensity X-rays have been combined to form a new technique for vibration test analysis. Ling Electronics and Zenith Radio Research Corp. have developed the system which produces 1-usec pulses of high intensity X-rays, operated in conjunction with a shaker. X-ray reproductions of the internal parts of hermetically sealed components are made observable on a tv screen while the subject is vibrated through a frequency range of 5 to 5,000 cps. The new technique makes it possible to study structural resonances in the interior of the component.

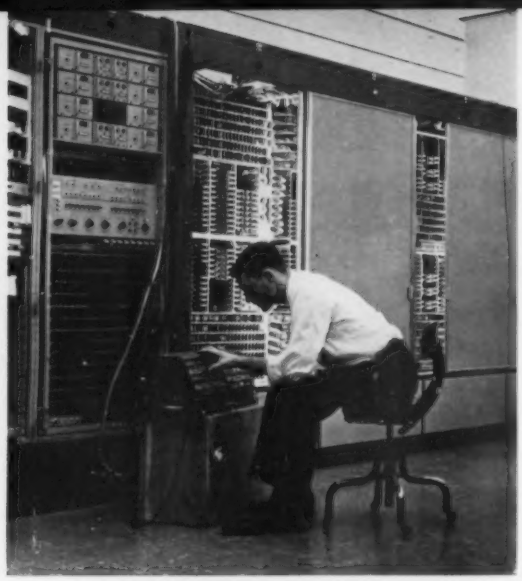
New technologies shape the future of communications

The United States Post Office Dept. has been conducting experiments on transmission of Speed Mail over long distances by bouncing signals off satellites. The project, managed by Adler Electronics Inc., used the Echo satellite to show that present equipment could send up to 50 letters in a three-minute period. Satellite links planned for the near future could permit transmission of six one-page letters, maps or pictures every second.

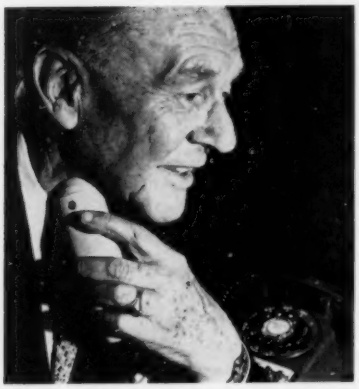
American Telephone and Telegraph Co. has filed application with the Federal Communications Commission for permission to put the first station of a satellite relay system into space within a year. Orbiting 2,200 miles above earth, the satellite, with its solar-powered amplifiers, would be used to relay telephone, tv and data signals between America and Europe. The initial system is expected to provide about 35 minutes transmission time three or four times a day — co-ordinated with the satellite passes over the earth station areas.

Raytheon Co. electrostatic printer tube shown by L. T. Jansen can print three pictures per second. Tiny wires, spaced 250 per inch, protrude through glass face of tube and deposit charge on paper as it moves past. Tubes can print 20,000 characters per second and operate with computing or transmission equipment.





An experimental telephone electronic central office has been installed at Morris, Ill. for field trials. The equipment, developed at Bell Telephone Laboratories, uses gas tubes in place of electro-mechanical relays for switching. A flying spot store, utilizing photographic memory plates and a cathode ray tube, can "remember" any one of the 2¼ million bits of information in one microsecond to determine routing and other functions necessary for completion of calls. The technician above is testing circuits in the administrative centre while technicians at left are shown installing a crt in the flying spot store. Apart from reducing switching time, the equipment can provide new services such as holding an incoming call until a busy line has been released.



Electronic larynx available at cost to laryngectomees from the Bell Telephone Co. of Canada transmits sound waves through the flesh and into the throat. Speech is produced by forming words with lips and tongue as in normal conversation.

The United States Post Office Dept. has been testing equipment to transmit mail electronically. The Stromberg-Carlson reader, above right, uses light from a cathode ray tube to scan the face of a document. Reflected light is picked by a photomultiplier tube and the resultant signal sent via video circuits to a printer in the distant city. The printer, above left, was developed by Stromberg-Carlson and Haloid Xerox Inc. To preserve privacy, equipment is being developed which will accept and deliver sealed mailing forms.

New components

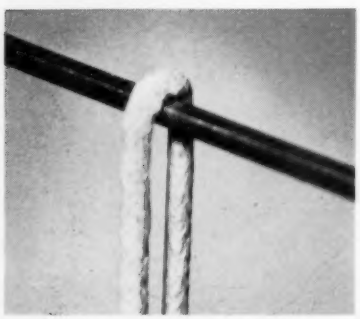
Reflex klystron 101

Developed and manufactured in Canada, this reflex klystron oscillator operates in the band 68.0 to 74.0 Gc. Features of the tube include single screw tuning over the band, small size, light weight, rugged construction, molded base and leads. It is suitable for operation in airborne and severe environments. A minimum power of 10 mw anywhere in the tuning range is produced with a beam voltage of 2500 volts.

Varian Associates of Canada Ltd., Georgetown, Ont.

New construction for asbestos cable 102

A new CSA approved construction of type A-16 (A) asbestos insulated cable using an asbestos braid, offers good abrasion resistance and prevents opening up on sharp bends. Also, the low insulation resistance values encountered with the original type when exposed for periods of time to damp or humid conditions have been greatly improved with this new construction.



H. K. Porter Co. (Canada) Ltd., Federal Wire & Cable Div., Guelph, Ont.

Pressure transducer 103

A rugged, miniature (1.000-in. diam., 2-in. body length) pressure transducer for measuring gaseous or liquid media in the ranges from 0-400 to 0-10,000 psi gauge or absolute has been developed by Fairchild Controls Corp. Model TP-1000 uses a variable mechanical amplification system to combine the high output signal and accuracy of potentiometer output elements with the reliability, ruggedness, accuracy and increased responsiveness of a helical bourdon tube pressure-sensing element.

It withstands 50 G's shock and 35 G's vibration and acceleration without damage, and survives MIL-E-5272C environments. It withstands overpressures of 25 % above rated (up to 100% above rated in special configuration) with negligible calibration shift. Static error band, including linearity, hysteresis, repeatability and friction is ±1% maximum deviation, depending upon total resistance value, from most favorable straight line. Total resistance values are 500 to 20,000 ohms, ±5%.

R. D. B. Sheppard, Ottawa.

High current thyraton 104

A new 6.4-ampere, 1,000-volt peak forward and 1,250-volt peak inverse thyratron, designated NL-6989/C6J/KL, was designed for control applications involving inductive loads. It has a high commutation factor, 130 v/usec x a/usec, which makes it useful in equipment involving rapid application of inverse voltage after conduction. It incorporates the National designed lug base as a standard feature. It is also available with the pin base and bracket base, designated as NL-C6J.K and NL-C6J/KP, respectively. Other ratings are: filament volts, 2.5; filament current, 21 amperes; peak anode current, 80 amperes; ambient temperature limits, –55 to +75 C.

National Electronics, Inc., Geneva, Ill.

(Continued on page 60)

New equipment

Video distribution amplifier 105

Designed and built in Canada, Central Dynamics Ltd. video distribution amplifier Type 1011 has the following specifications: Input impedance of 500 k shunted by 12 pf approx.; gain of -3 to +15.5 db continuously adjustable; differential gain less than 0.1 db with 1 volt peak to peak output, and less than 0.3 db with 2 volts peak to peak output; differential phase is 0.5 deg. with 1 volt peak to peak output signal; frequency response is ±0.1 db to 4 Mc; ±0.25 db from 5 Mc to 8 Mc; and less than 2 db down at 10 Mc; output impedance is 75 ohms ±5%; tilt is 1% at 60 cps; time delay is 30 nanoseconds.

Aeromotive Engineering Products Ltd., Montreal.

Industrial 2-way radio 106

The DK33 "Car-go-Call" industrial radio unit has been designed for short-distance communications in industry. The unit is compact enough to be mounted directly on lift trucks and other materials handling vehicles. It is self-contained.

Canadian Marconi Co., Montreal.

Voltage reference source 107

Dynamaster potentiometers are now available with a new voltage reference source which eliminates the need for standard cell, dry cell, and standardizing mechanism. It is ac operated, and optimum isolation of the output circuit from the line supply is maintained. Zener diodes are the reference elements in the pre-regulating and output stages of the regulating circuit. Accuracy of the voltage reference source is ±0.05% (110-125 volts ac, 50-60 cps; ambient temperature range, 14-50 C). The output change is only 0.002% per volt of supply voltage

New instruments

change. The output voltage (dc) at 117 volts supply (25 deg. C.) is equivalent to that of a standard cell, 1.0190 volts, ±0.05%. Capacity is 3.0 ma at rated voltage.

The Bristol Co. of Canada Ltd., Toronto.

Ultrasonic impact grinder 108

Model 2-333 ultrasonic impact grinder is designed for precision machining operations in the manufacture of semiconductor and other electronic devices. It can be used for general purpose work including cleaning and soldering. It features an air-cooled, 300-watt magnetostrictive transducer which provides continuous operation without down-time for cooling. The transducer is an insert-type

so that either the coil or the transducer can be removed without disturbing the other.

Raytheon Canada Ltd., Waterloo, Ont.

DC amplifier 109

AccuData III is a chopper-stabilized, dc amplifier with both single-ended and differential input connections. Maximum gain is 34,000; input impedance is 20 megohms single-ended, or 2 megohms differential; output current is 65 ma at 5 volts, or 25 ma at 10 volts. Output impedance is less than 0.1 ohms.

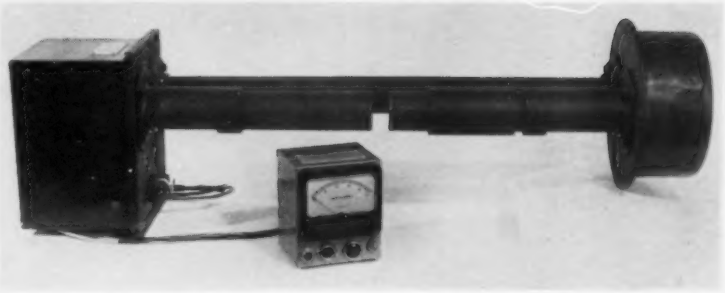
Honeywell Controls Ltd., Toronto.

Thermocouple selector switches 110

Several newly designed rotary, key and push-button selector switches for thermocouple and resistance thermometer applications provide rapid switching from 1 to 144 sensing elements. Primary use is when temperatures being sensed by a number of thermocouples must be checked frequently or switched from one measuring instrument to another. Rotary models have capacity for 6, 12 or 24 points. Key switches are available with either locking or non-locking construction. Push-button switches have interlocking action.

Thermo Electric (Canada) Ltd., Brampton, Ont.

(Continued on page 63)



Air pollution monitor 111

Designed and built in Canada, air pollution monitor type APM-11 is intended for the detection and continuous monitoring of the presence of smoke, or other air polluting agents. It consists of a smoke density detector, teminal indicator bay (with or without alarm), metal tubes and flanges for mounting in an exhaust system. It operates on the principle of comparing two signals, one proportional to the monitored smoke density, the other being a reference signal set in advance to the desired level.

Presentey Engineering Products Ltd., Ottawa.

Directional wattmeter 112

Model 43 "Thruline" directional wattmeter is an insertion type instrument for measuring forward or reflected power in coaxial transmission lines in the frequency range 2 to 1000 Mc. Each instrument is made up of a line section and indicating meter contained in an aluminum case. The line section is a precisely designed 50 ohm coaxial air line for insertion in the transmission line. Each line section is equipped with a socket into which a measuring element in the desired frequency band and power range is inserted. Ends of line sections are equipped with quick-change rf connectors. The meter is a sensitive microammeter with 25, 50 and 100 watt scales. Plug-in measuring elements are self contained directional detectors, calibrated for direct indication of rf power in the ranges 10, 25, 50, 100, 250, 500 and 1000 watts.

Bird Electronic Corp., Cleveland.

Compact instrumentation recorder 113

Compact, extended frequency magnetic tape recorder/reproducer type CP-100 is a complete 7 or 14-channel recording and reproducing system designed primarily for instrumentation or general laboratory application. It can be operated in its mobile case or mounted in a standard 19-in. rack. It accommodates either ½ or 1-in. tape on 10½ in. reels, and provides six tape speeds: 1⅞, 3¾, 7½, 15, 30 and 60 inches per second. Direct or FM carrier recording is employed with frequency response from dc to 200 kc, —25db signal-to-noise ratio.

Ampex of Canada Ltd., Ottawa.

Storage and real time oscilloscope 114

Utilizing the basic circuitry and chassis of model 401-B general purpose oscilloscope, the new Du Mont type 430 StoreScope incorporates added drivers for the storage cathode ray tube. A P10 phosphore is employed, which produces a dark trace on a light background whose actual storage time is determined by both ambient temperature and density of recorded trace. Erasure can be accomplished in a maximum of 15 seconds with a recycle every 40 seconds.

Additional specifications include sweep range from 50 usec/cm maximum to 100 seconds full scale. Band width is nominally 10 kc in both axes and identical amplifiers are incorporated. The

scan is 9 x 12 cm with 10 kv acceleration. Nominal spot size is 0.018 in. Tentative specification for writing speed is 30,000 cm/sec. The StoreScope has an erase warning light, and back lighting for photo recording.

Bayly Engineering Ltd., Ajax, Ont.

(Continued on page 64)

People — continued

Lindsay

McGovern

Lennox

Wootten

Lindsay appointed general manager

W. H. Brady Co. of Canada, Ltd., has appointed **Erwin Lindsay** general manager. He was formerly sales manager for Kenley Industrial Corp., Toronto, and district manager for Sandvik Canadian Ltd., Montreal. He replaces **P. G. Vienot** who is assuming new duties with the parent company in Milwaukee.

Marketing manager for Canadian operations

Thomas F. McGovern has been appointed marketing manager of Keuffel & Esser of Canada Ltd. He will be responsible for planning, directing and controlling sales activities of K&E in Canada. Prior to this appointment Mr. McGovern was district sales manager of Sylvania Electric of Canada Ltd., and also served with Northern Electric Co. Ltd.

Tele-Radio Systems appoints buyer

Tele-Radio Systems Ltd. has appointed **Ian Barrie Lennox** as purchasing agent. A graduate of Ryerson Institute of Technology, Mr. Lennox has served with Canadian National Telegraphs, engineering department.

Instrumentation engineer joins R-O-R Associates

John Wootten has joined R-O-R Associates Ltd., to direct the systems and applications operation which is being generated by their broad equipment representation. For the past twenty years he has been working in the communications, radar and instrumentation fields, and prior to joining R-O-R was the chief of instrumentation laboratories at Avro Aircraft where he was responsible for all ground and airborne instrumentation projects. At R-O-R Mr. Wootten will be responsible for all systems engineering and for special applications and adaptation of R-O-R instrument product lines.

Raymond A. Tulloch has joined the staff of Canadian Electronics Engineering as Manitoba Editor, succeeding **Robert A. Metcalfe** who has moved to Vancouver as British Columbia Editor. Former B. C. Editor **Arthur R. Joy** has been made editor of another Maclean-Hunter business paper.

Reports — continued

J. J. MacQuarrie Sales, Toronto, has been appointed by Chicago Dynamic Industries Inc., Precision Products Division, to handle its entire line of removable wafer rotary selector switches, digital and binary coded thumbwheel switches, and precision counters in Eastern Canada.

Rush S. Drake Associates Inc., Seattle, Wash. have been named B.C. rep. for Digital Equipment Corp., Maynard, Mass. (logic circuit packages, digital computers and systems).

The appointment of **Paisley Products of Canada Ltd.,** Scarborough, Ont. as exclusive sales representatives throughout Canada has been announced by Mycalex Corp. of America, Clifton, N.J. (glass-bonded mica, ceramoplastics, synthetic mica products, telemetry switches, tube sockets).

Sony tape recorders, manufactured in Japan, are being introduced in Canada by **General Distributors Ltd.,** Winnipeg. Two models, the 101 and the 262, are to be distributed initially.

Companies on the move

Canadian Research Institute, formerly at 46 St. George St., Toronto, have moved into their new plant and offices at 85 Curlew Drive, Don Mills, Ont. Telephone number is 447-5561.

David R. Beattie, manufacturers' representative, has moved his office from Clarkson, Ont. to 1415 Lawrence Ave. W., Toronto 15. Telephone: CHerry 9-4401.

Presentey Engineering Products Ltd., Ottawa, has expanded its operations in additional plant space at 233 Armstrong Ave., Ottawa 3. Telephone: PArkway 9-7171.

Desser E-E Ltd., Montreal, importers and manufacturers' agents, have opened an Ontario sales office at 96 Abercorn Rd., Markham, Ont. Telephone number is AXminster 3-8435. W. (Bill) Wilson has been appointed Ontario sales manager.

C. P. Clare Canada Ltd. have moved from Downsview, Ont. to larger facilities at 840 Caledonia Rd., Toronto (former home of Daystrom Ltd.). The 10,000-sq ft building will enable the firm to increase its production and manufacture a wider range of Clare products in Canada, including the Type F subminiature relay that is to be used in the CF-104 navigational systems.

International Business Machines Co. Ltd. will house all of their downtown Toronto facilities in a new $1.5 million building to be erected on the site of the present IBM building at 32 King St. E.

Pye sells ILS to RCAF

Pye Canada Ltd. has received a Department of Defence Production contract for an Instrument Landing System to be installed at the RCAF Station, Trenton, Ontario.

Pye ILS has British Ministry of Aviation approval and is standard with the RAF, meeting and in many respects exceeding the stringent ICAO specifications. It is a major factor in the development work conducted by the Blind Landing Experimental Unit of the Royal Aircraft Establishment at Bedford, England. In the course of the development program many thousands of successful automatic "hands-off" landings have been made.

Air France buys Canadian navigation equipment

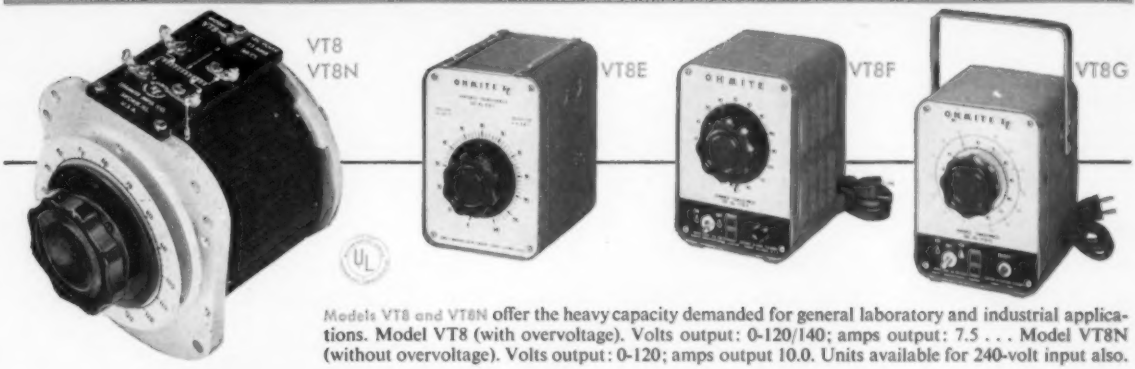
Air France, "World's Largest Airline", is the seventh international air carrier to order Canadian Marconi Company's airborne doppler navigation system. It will be installed in their fleet of Boeing 707 jet aircraft.

Popular, small Model VT2 (with overvoltage). Volts output: 0-120/132; amps output: 1.5 . . . Model VT2N (without overvoltage). Volts output: 0-120; amps output: 1.8. This model delivers more current than existing transformers of comparable size and price.

Models VT4 and VT4N Model VT4 (with overvoltage). Volts output: 0-120/140; amps output 3.5 . . . Model VT4N (without overvoltage). Volts output: 0-120; amps output: 4.75.

OHMITE

VARIABLE TRANSFORMERS
Complete Line Now Available from Stock



Models VT8 and VT8N offer the heavy capacity demanded for general laboratory and industrial applications. Model VT8 (with overvoltage). Volts output: 0-120/140; amps output: 7.5 . . . Model VT8N (without overvoltage). Volts output: 0-120; amps output 10.0. Units available for 240-volt input also.

Now you can get *fast delivery from stock* on 38 different models of Ohmite variable transformers. This newly expanded selection covers a high percentage of industrial needs. In it you will find single and three-phase units, two and three-in-tandem assemblies (not shown above), plus a variety of other cased and uncased models.

Ohmite "v.t." variable transformers combine fresh thinking in design with traditional Ohmite quality. For example, positive current transfer is achieved with direct brush to slip-ring, pig-tailed connection. Adjustable shafts on sizes VT4 and VT8 extend either to the brush or the base side. These two models also are *interchangeable* with competitive makes of comparable ratings. The "N" types in all three models provide additional current without overvoltage. The next time you need variable transformers, select from the line with advanced design—Ohmite.

NEW 36-volt, high-current units for transistor circuit applications... write for Bulletin 151

RHEOSTATS RESISTORS RELAYS
TAP SWITCHES TANTALUM CAPACITORS DIODES
VARIABLE TRANSFORMERS R. F. CHOKES

OHMITE

OHMITE MANUFACTURING COMPANY
3623 Howard Street, Skokie, Illinois

A. C. Simmonds & Sons, Ltd.
100 Merton Street
Toronto 7, Ontario, Canada

C. M. Robinson & Company
1550 Erin Street
Winnipeg 3, Manitoba, Canada

For further information mark No. 41 on Readers' Service Card

Technical Institutes—cont.

The following list will provide an indication of courses related to industrial electronics given in Canadian technical institutes. It must be recognized that changes in this field are taking place quite rapidly and anyone wishing further information is invited to contact the editors of CEE.

Name of institute	Electrical	Electronic	Instrumentation
New Brunswick Technical Institute, Moncton	✓	✓	
Instituts de Technologie:			
d'Arvida	✓		
de Choutimi	✓	✓	
de Hull	✓	✓	
de Lauzon	✓	✓	
de Laval (Montreal	✓		✓
de Montreal	✓	✓	
de Rimouski	✓	✓	
de Shawinigan	✓	✓	
de Sherbrooke	✓	✓	
de Trois-Rivieres	✓	✓	
Ryerson Institute of Technology, Toronto	✓	✓	✓
Eastern Ontario Institute of Technology, Ottawa	✓	✓	✓
Hamilton Institute of Technology, Hamilton	✓	✓	✓
Western Ontario Institute of Technology, Windsor	✓	✓	
Manitoba Technical Institute, Winnipeg		✓	
Saskatchewan Technical Institute, Moose Jaw		✓	
Provincial Institute of Technology and Art, Calgary	✓	✓	
Federal-Provincial Trades and Technical Institute, Burnaby, B.C.		✓	

The technical institutes have slight variations in their entrance standards. They require senior matriculation, often with extra requirements such as 70% in mathematics. The courses listed above require two or three years to complete when taken as a regular day-time course; some are available as evening courses. Graduates of the institutes receive official technician ratings from some of the provincial Associations of Professional Engineers, and from the Corporation of Technicians of the Province of Quebec.

Private schools

While a number of privately-owned schools have been operating in Canada, most of them have been providing instruction only in the area of radio and tv receiver servicing, or communications.

Radio College of Canada, with schools in Toronto and Montreal, offers a number of day, evening and correspondence courses in a variety of electronic subjects. Graduates of the Electronics Engineering Technology course qualify for classification as Engineering Technician Grade 3 under the Association of Professional Engineers of Ontario.

Recently, a course in Industrial and Automation Electronics has been started at Radio College of Canada.

DeVry Technical Institute of Canada Ltd., Toronto offers a 72-week course in Electronic Technology, designed to provide students with a broad, fundamental knowledge of electronics. END

The AMPEX FR-400 is a versatile, dual-speed digital magnetic tape handler for use with computers and auxiliary digital equipment with transfer rates up to 22,500 characters per second. It is a reliable, efficient input source for operating printers, plotters, computer language translators and paper tape and card punching equipment. It is used to record the output of punched cards and paper tape reading equipment, and analog-to-digital converters. The standard speeds of the FR-400 are 75 and 37½, or 60 and 30 inches per second. Other ranges can be supplied on special order. Fast start/stop times of under 5 milliseconds provide maximum tape utilization. Compact, all-transistorized etched circuit electronic assemblies assure reliable performance and low power consumption. The FR-400 is available in models for ½, ¾ or 1-inch tape, providing from 7 to 16 data channels. Pushbutton controls, straight-line threading, power interlocks and end-of-tape sensing simplify operation. Complete technical performance specifications and information on your specific applications are available from Ampex of Canada Ltd., 607 Commonwealth Bldg., Ottawa, Ontario AMPEX

For further information mark No. 12 on Readers' Service Card

Defence contracts

Unclassified electronics contracts for $10,000 or more have been awarded to the following Canadian firms by the Department of Defence Production. A figure in parentheses indicates the number of contracts, the amount being the total value.

October 1-15, 1960

- Aircraft Marine Products of Canada Ltd., Toronto, terminal kits, $10,462.
- Bayly Engineering Ltd., Ottawa, electric pens for multi-channel recorder equipment, $28,882.
- Burgess Battery Co., Niagara Falls, Ont., batteries, $23,232.
- Canadian Marconi Co., Montreal, installation of radio equipment, antennas, and associated accessories, $84,465.
- Canadian Westinghouse Co. Ltd., Ottawa, components, $13,109.
- Collins Radio Co. of Canada Ltd., Toronto, technical representative, $13,785; antennas, $61,974.
- Electromechanical Products, Agincourt, Ont., frequency meters, $52,025.
- Helipot Division, Beckman Instruments Inc., Toronto, repair, overhaul and/or lubrication of potentiometers, $10,000.
- Instronics Ltd., Stittsville, Ont., receivers, $15,851.
- TMC (Canada) Ltd., Ottawa, transmitters, $84,576.
- Technical Enterprises Ltd., Malton, Ont., insulators, $17,719.
- Varian Associates of Canada Ltd., Georgetown, Ont., tubes, $65,233.

October 16-31, 1960

- Aviation Electric Ltd., Montreal, overhaul of aircraft instruments and accessories, $931,370; indicators, $807,649.
- Canadair Ltd., Montreal, design and engineering for aircraft systems trainer, $424,000; development of airborne electronic equipment, $123,189.
- Canadian Westinghouse Co. Ltd., Ottawa, magnetrons, $48,799.
- Computing Devices of Canada Ltd., Ottawa, weather and terrain mapping radar equipment, $11,687.
- Cowley Electronic Services Ltd., Edmonton, installation of radio equipment, antennas, and associated accessories, $49,080.
- Electric Storage Battery Co. (Canada) Ltd., Toronto, batteries, $28,953.
- Electronic Materiels International Ltd., Ottawa, development and manufacture of pre-production test models of high frequency amplifiers and associated hardware, $32,994.
- Fleet Manufacturing Ltd., Fort Erie, Ont., sonar hull units, $411,454.
- General Precision Industries Ltd., Montreal, magnetic recorders, $98,623.
- International Business Machines Co. Ltd., Ottawa, rental of electronic data processing machines, $92,333.
- Lenkurt Electric Co. of Canada Ltd., Vancouver, supply and installation of compandor unit assembly, $17,268.
- Mel Sales Ltd., Toronto, equipment, $12,391.
- Northern Electric Co. Ltd., Ottawa, supply and installation of telephone equipment, $408,923.
- Pye Canada Ltd., Toronto, dual localizer installation, $69,403.
- RCA Victor Co. Ltd., Montreal, revision to handbook, $16,559; research contract, $79,330.
- R-O-R Associates Ltd., Don Mills, Ont., tube shields, $21,927.
- Standard Telephones & Cables Mfg. Co. (Canada) Ltd., Montreal, test signal generators, $916,432.

CAMESA News

This bulletin has been prepared for CEE by the Specifications Division, Canadian Military Electronics Standards Agency, Ottawa.

- Supplement 1 to Specification **MIL-S-3950A,** covering toggle switches has recently been issued for Canadian procurement. This supplement lists all the military standards associated with Specification MIL-S-3950A, including revision "C" to MS35058 and MS-35059.

- Specification **MIL-F-15733D,** which is a general specification covering radio interference filters, and individual specification sheets **MIL-F-15733/1 through /5** have recently been issued. Of interest is the revision and expansion of the type designation in order to give much more information.

- Revision "A" to Canadian Specification Sheet **CSS-86,** associated with Specification **MIL-R-26C,** has recently been issued. This CSS covers miniature fixed wire-wound power resistors. Revision "A" reduces the resistance tolerances on resistors of less than one ohm from $\pm 10\%$ to $\pm 5\%$, and decreases the transverse load from 50 pounds to 25 pounds for the mechanical strength test. The requirements for wire diameters have also been revised.

- Specification **MIL-R-12934B** covering precision variable wire-wound resistors has been issued recently. Because of the many variables encountered with this type of part, the type designation has been expanded to include two functions, six classes and grades, two mechanical characteristics, three rotational life characteristics, and twenty-four function conformity tolerance and resistance tolerance characteristics. Provision is also made for procuring items not covered by the type designation or having requirements which differ from those of the specification. Tests, requirements and definitions have also been revised to reflect the current state of the art.

One after another, new Canadian products are evolving from ONE basic development... Bach-Simpson's miniature motor-generator

Simple in concept, complex in execution, the miniature motor-generator is an example of design problems overcome. Precisely engineered and tooled in its entirety in Bach-Simpson Limited's comprehensive Canadian facility, its application becomes steadily more varied.

FREQUENCY METER — First of the family, this accurate pointer-type device derives from the motor-generator's ability to produce output voltage linearly related to input frequency.

CONTROLLER-INDICATOR — In frequency control, the motor-generator's surplus torque is used to produce interrogating pulses for periodic sampling of the indicated quantity. For control of other functions, the motor alone is used.

CONSTANT VOLTAGE SOURCE — The synchronous motor's remarkable independence of input voltage fluctuations is utilized to produce constant voltage output with constant input frequency.

FREQUENCY-ELAPSED TIME METER — The pointer-type frequency meter's motor-generator provides the driving force for Bach-Simpson Limited's new large read-out elapsed time indicator.

. . . and we've got more ideas!! HOW ABOUT YOU?

Bach-Simpson
LIMITED

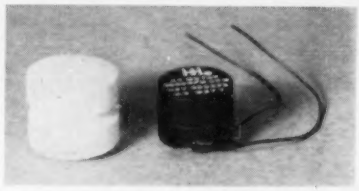
1255 BRYDGES STREET, LONDON, ONTARIO

For further information mark No. 17 on Readers' Service Card

New components—cont.

Micro-miniature timers 115

The A. W. Haydon Co. has developed a pair of micro-miniature timers driven by an Aspirin-sized motor. Small enough to be hidden behind an ordinary thumbtack, the 115-volt, 400 cps, single phase hysteresis-type motor measures ⅜ in. in diameter by 9/32 in. in length, and consumes less than one-half watt power. The torque is rated at 1.5 x 10^{-6} horsepower (0.0005 ounce-in.), and its weight is given as 1/9 ounce.



The motor was developed to power a hermetically sealed repeat cycle timer measuring ½ in. x 1 in. x 1 in. Three roller switches in the timer are driven at 1 rpm by the motor, while the switches in the device are rated for seven amperes resistive at 28 volts dc and 4 amperes resistive and inductive at 115/230 volts, 60 cps.

The second device powered by the motor is a digital elapsed time indicator. The four-digit indicator measures only one-half in. square by 1-1/16 in. long, and operates from a frequency of 400 cps. Weighing ¾ of an ounce, the instrument comes in two models; one reading tenths of hours, and the other registering hours. Both employ four digit, drum-type counters having ranges of 999.9 and 9999 hours respectively.

Philips Electronic Industries Ltd., Toronto.

Solventless silicone resin 116

Formerly marketed under the experimental designation Y-2090, this solventless silicone resin is now sold as XR-65 Silicone. It is available in one pint, one gallon, five gallon and 55-gallon containers. It can be used for form-wound coil impregnation, for lamination using wet lay-up techniques, and for potting and encapsulation. It is 100% reactive silicone resin. In addition, it can be combined with organic monomers to provide tailor-made insulating resins. The need for solvent removal during curing is eliminated by its use.

Union Carbide Canada Ltd., Bakelite Div., Toronto.

Connector 117

Scotchlok type UR is a self-stripping, self-sealing, preinsulated wire connector designed for the telephone, communications and signaling industries. It is made of a transparent, thermoplastic material filled with silicone grease. The connectors incorporate a metal finger-like connector element. It is designed to accommodate one two or three wire combination of No. 19 to No. 26 AWG solid or No. 20 to No. 26 AWG stranded

wire. Pullout resistance is equal to 95% of wire breaking strength.

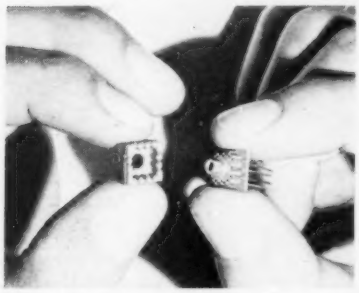
Minnesota Mining and Manufacturing of Canada Ltd., London, Ont.

Micro-miniature connectors 118

Two new series of Micro-Miniature connectors have been developed and introduced by Amphenol.

The "Micro-Min" — 75 Series, is available in 19 contacts, single side and 38 contacts double side, and is intended for use in flat form packaging. The 19 contact connector pair consists of a receptacle and a mating board, which may be used for component mounting, or as an adaptor to flexible flat cable or to a printed wiring board. For double sided wiring boards, 2 flexible cables or printed circuits, the 38 contact "Micro Min" can be used. In both the 19 & 38 contact versions, contacts are on .050 in. centres, and connector length is 1-5/6 in.

The "Micro Mod" — 96 Series, provides a means of inter-connection and quick removability for "stick" or module packaged circuits. Two versions are available. One mating pair consists of a receptacle and receptacle base, and a polarized plug. In the alternate pair, the



receptacle is supplied without the contacts. In certain cases the module leads can then be used to form the female contacts. Both mating pairs have 12 contacts on .075 in. centres. The Micro Mod. is .380 in. square.

Amphenol Canada Limited, Toronto.

Silicon controlled rectifiers 119

A new line of low current silicon controlled rectifiers is available in eight models. The C11 has been designed for those applications not requiring the full power rating and high temperatures of the C10. The C11 will find applications in light dimming controls, speed control for motors and as replacement for relays. The eight models differ by repetitive peak reverse voltage ratings which range from 25 volts for the C11U to 400 volts for the C11D. The average forward current rating is up to 4.7 amperes. Typical gate current required to fire the units is 4.0 ma at 0.60 volts, while the maximum gate voltage to fire is 2.0 volts. Typical turn-on time is 2.0 usec and typical turn-off time is 15.0 usec.

Canadian General Electric Co. Ltd., Toronto.

(Continued on page 62)

New components—cont.

Branched coaxial line duplexers 120

Additions to the microwave components line offered by Bomac Laboratories, Inc., are branched coaxial line duplexers, utilizing two cell-type TR tubes and a single cell-type receiver protector tube. In the 3⅛ inch unit shown, two band pass filters are shown, one in the receiver circuit and one in the AFC pick-up circuit. Visible also are directional couplers used for measuring transmitter power and antenna circuit VSWR.

The unit is rated as follows: frequency 406-450 Mc; transmitter power output, 3Mw max.; transmitter power output (average), 5 Kw max.

R-O-R Associates Ltd., Don Mills, Ont.

Printed contact relay 121

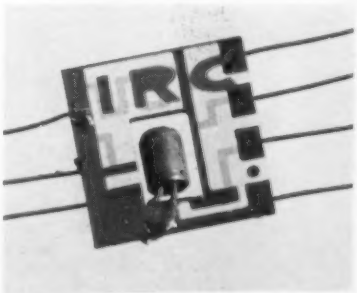
Printac is a new permanent magnet printed contact relay series. The new concept uses preadjusted bar contacts in an armature and moving contact assembly which make direct contact with conductors on the user's printed circuit board. It is applicable to printed circuit component insertion techniques. Switching combinations of up to three-pole, double-throw may be achieved by proper arrangement of the conductors printed on the user's board. A ceramic permanent magnet is the heart of the magnetic motor assembly. Application of an electromagnetic field opposing the field of the permanent magnet causes the relay to operate. Absence of springs or mechanical linkages eliminates the need for adjustment and achieves higher reliability.

Executone, Inc., Long Island City, N.Y.

Micro-circuitry 122

A new technique in micro-circuitry has been developed by IRC. Called the MU circuit, it is adaptable for adder, pre-amplifier, binary counter and logic circuits. MU circuits offer increased space efficiency and afford the designer the opportunity to use existing circuitry ideas merely by translating them in MU circuitry.

IRC Resistors, Toronto.



Coaxial cable 123

Type NEF-11DT coaxial distribution cable is available for community-antenna television systems. It is an expanded foam polyethylene insulated 75-ohm distribution cable comprised of a solid centre copper conductor, supplemented by a copper braid immediately over the tape and finally, a polyethylene jacket.

Northern Electric Co. Ltd., Montreal.

New equipment—cont.

Bobbin coil winding machine 124

The Bobbin Gobbler can wind twelve coils at once, all in different sizes and wire gauges if desired, and all twelve operations can be handled by one operator. The machine proper consists of

a base containing variable drive motors, a revolving table holding 12 winding heads, and superstructure designed to accommodate No. 26 Capstan Dereelers or buckets plus one spare head. Operation requires 220/440-volt, 60-cps, 3-phase supply, and 2 CFM at 80 pounds air pressure.

Crown Tool, Inc., Wabash, Indiana.

Two-way radio 125

A new table model two-way radio has been designed to provide service while occupying less space than former models. Units up to 60 watts are available in low band (25-54 Mc and 72-76 Mc), up to 50 watts in high band (144-174 Mc) and 15 watts in UHF (450-470 Mc). Depending on the frequency selected, power amplifying equipment can be obtained on an optional basis, providing 250/330 watts output. Also available optionally is selective-calling.

Canadian General Electric Co. Ltd., Toronto.

Multi-voltage reference source 126

Voltage Reference Mercury Battery provides accuracy approaching that of standard laboratory grade reference cells. It has an accuracy of ±½% of

stated open circuit voltage and is temperature stable within 1% from -20 deg. F to ±160 deg. F at drains up to 100 microamperes. For short periods this reference battery is accurate to one part per million and to within ±½% for three years or more at normal temperature. It provides eight outputs from 0 to 10.8 volts in increments of 1.35 volts.

Mallory Battery Co. of Canada Ltd.

Infrared phone 127

A new communication system, Infraphone will be marketed as a consumer item through specialty outlets. In operation, the hand-held, self-powered Infraphone is aimed at another unit anywhere within its line-of-sight. Both phones are identical transmitter-receiver units, and talking and listening may be simultaneous, as with a telephone. It is powered

by ordinary flashlight batteries and clarity of conversation is comparable to telephone.

Infrared Industries, Inc., Waltham, Mass.

(Continued on page 64)

New instruments—cont.

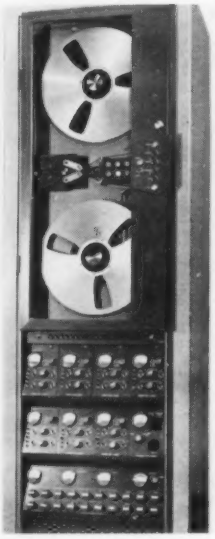
Insulation tester 128

Portable Megohmeter model L-5 has been designed for testing short circuits in motors, transformers and other such equipment. It employs a hand-driven, governor - controlled, constant - voltage generator, with duo-moving coil, core magnet meter and jewel pivoted bearings floating on neoprene shock absorbers. Accuracy is 5% of indicated value, with scale length of 3½ in. It is available in five ranges: 100v/20 megohms to 1000v/2000 megohms.

Stark Electronic Instruments Ltd., Ajax, Ont.

Magnetic tape system 129

Model CM-100 wide-band recorder/reproducer stores both analog and digital data with equal facility. There are seven wide-band tracks to a single ½ in. magnetic tape and bandwidth is 400 cps to 1.0 Mc. There are six tape speeds from 7½ to 120 ips. The CM-100 is capable



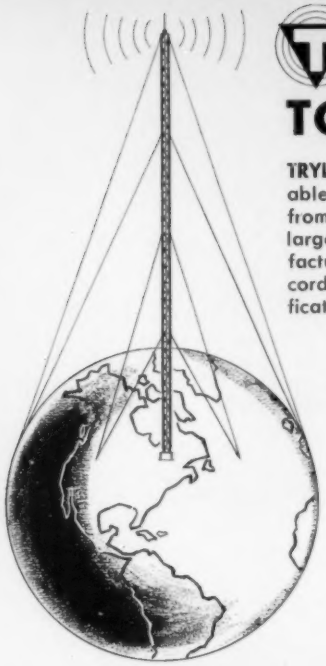
of recording one microsecond pulses spaced one microsecond apart at 120 ips.

Minnesota Mining & Manufacturing of Canada Ltd., London, Ont.

Miniature recorder 130

Elmes model 12 miniature recorder has a circular chart 3¼ inches in diameter which gives a full scale chart length of over 10 inches. Six chart speeds from 1 rph to 1 revolution in 30 days are driven by a 115 v, 60 cps, synchronous motor. Recording is made by a pressure pin on special paper. The recorder is available for ac and dc voltage, current, wattage and temperature in sensitivities as high as 10 microamperes full scale.

Canadian Research Institute, Toronto.



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Switch capsule consists of a pair of magnetically operated contacts, hermetically sealed in an atmosphere of inert gas.

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CLAREED relays are ideal components for transistor-drive applications and for use in computers and data-processing equipment. Their low inductance, and the low inductance change in the operating coil at each operation, limits the transients produced.

Important features of CLAREED relays are their simplicity and flexibility. They may be mounted to meet the requirements of almost any application and environmental condition, even on your own printed circuit board—to comply with your mechanical design configuration.

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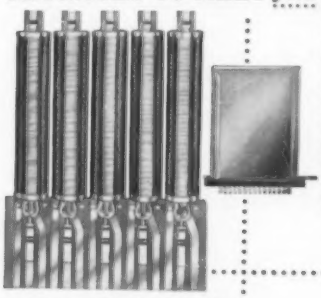
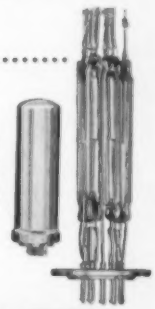


Ten CLAREED switches, mounted in line on a printed circuit board with five magnetic coils. This assembly can then be enclosed in the flat, rectangular container or it may be coated with "Skin-Pack," a tough vinyl plastic, and mounted directly into your equipment.

CLAREED relays are as flexible as your application requires. Additional information may be obtained from C. P. Clare & Co., 3101 Pratt Blvd., Chicago 45, Illinois. In Canada: C. P. Clare Canada Limited, 840 Caledonia Road, Toronto 19, Ont. Cable address: CLARELAY. *Send for Bulletin CPC 5.*



Six CLAREED switches clustered for mounting in a single tube container.

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SMPTE will hold international convention in Toronto

The Society of Motion Picture and Television Engineers will hold its 89th Convention at the King Edward-Sheraton Hotel, Toronto, May 7-12, 1961. This will mark the first time that the convention has been held outside of the United States and the theme has been established as: "International achievements in motion pictures and television."

Papers are being sought for the following thirteen topics: Laboratory practices; Film projection equipment; New Developments in 8mm; Standards and standardization; Image forming systems; Sound recording and reproduction; Cinematography; Television equipment; Television studio practices and station operation; Television recording; Film and television in education; Television film; Instrumentation and high speed photography.

Author forms may be obtained from Rodger J. Ross, 89th SMPTE Program Chairman, c/o Canadian Broadcasting Corporation, 354 Jarvis Street, Toronto, Ontario. Deadline for submission of papers is February 15, 1961.

In addition to the technical papers there will be a special session devoted to equipment papers and demonstrations. This session will be held to provide exhibitors an opportunity to describe and demonstrate some of the outstanding aspects of their equipment. For further information about exhibit space and the special session, write to Kenneth S. Oakley, Exhibit Chairman, 89th SMPTE Convention, c/o Bell & Howell Canada Ltd., 88 Industry St., Toronto, Ontario.

National industrial production show

The Canadian Industrial Management Association will co-sponsor the National Industrial Production Show of Canada to be held for the third time at Exhibition Park, Toronto, May 8-12, 1961. Seminars will be held at the same time in adjoining rooms at the Industry and Coliseum buildings. Space available for exhibits will exceed that of the 1959 show.

Canadian exhibits abroad

In the face of steadily mounting competition for world markets, the Department of Trade and Commerce is planning the biggest trade fair program in Canada's history. A new booklet, "Canada Exhibits Abroad in 1961", provides information on 16 international trade fairs for which the Department is now organizing Canadian participation. Copies of the booklet are available from the Editorial and Art Services Division, Trade Publicity Branch, Department of Trade and Commerce, Ottawa.

At its 9th annual conference held in Toronto, Oct. 25 and 26, the Engineering Section of the Central Canada Broadcasters' Association elected its executive for 1961. They include (l-r) Dick Salway, CFRB, Toronto; Dale Duffield, CFPL-TV, London; Bill Jeynes, CHCH-TV, Hamilton; Gord Ballantyne, CKGN-TV, North Bay; Scott Reid, CKNX-TV, Wingham.

IRE Section meetings

Kitchener - Waterloo: Dec. 19; "Pulse sampling," by M. B. Crouch, Tektronix, Inc.; University of Waterloo, 8.15 p.m.

Ottawa: Jan. 5, 1961; "Project Mercury," by M. Yurko, TMC (Canada) Ltd., Ottawa.

Toronto: Jan. 9, 1961; "Applications of Ultrasonic Energy," by Canadian Westinghouse Co. Ltd. (speaker to be announced); Hart House, 7 p.m.

COMING EVENTS

December

11-14 Eastern Joint Computer Conference, IRE, AIEE, ACM, New York.

12-15 Atomfair-West, and American Nuclear Society 1960 Winter Meeting, San Francisco.

14-16 Atomic Industrial Forum 1960 Annual Conference, San Francisco.

January 1961

17-19 ISA Winter Instrument-automation Conference & Exhibit, St. Louis, Mo.

February

1-3 1961 Winter Convention on Military Electronics (IRE), Biltmore Hotel, Los Angeles.

17-21 4th International Exhibition of Electronic Components, Parc des Expositions, Porte de Versailles, France.

20-25 International Symposium on Semiconductor Devices, UNESCO House, Paris, France.

Feb. 26-Mar. 1. Pacific Electronic Trade Show, Los Angeles, Calif.

March

16-17 Conference on data processing problems in engineering and scientific research, sponsored by The University of Arizona, Tucson, Ariz.

20-23 IRE International Convention, New York.

21-25 Electrical Engineers (ASEE) Exhibition Ltd., Earls Court, London.

May

3-13 British Columbia International Trade Fair, Exhibition Park, Vancouver.

7-12 89th Society of Motion Picture and Television Engineers Convention, King Edward-Sheraton Hotel, Toronto.

8-10 National Aeronautical Electronics Conference, Dayton, Ohio.

8-12 National Industrial Production Show of Canada, Exhibition Park, Toronto.

What's ahead for electronics?

The Canadian Electronics Industry must develop new markets if it hopes to thrive. There is potential business in exports, particularly for low volume, specialized equipment which Canadians are capable of designing and building at competitive prices. The January issue of CEE, which is the annual Review and Forecast issue, will provide detailed information on Canadian developments and their position in world markets.

Latest available statistics will also be presented to show where our industry now stands and where it is heading.

Free service for our readers

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For extremely low current level measurement, sensitivity can be increased by looping the conductor through the "jaws" of the 428A probe two or more times.

Brief specifications are given here; for complete details and demonstration *on your bench*, call your representative or write direct.

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Accuracy: ± 3% ± 0.1 ma.

Probe Inductance: Less than 0.5 μh maximum.

Probe Induced Voltage: Less than 15 mv peak.

Effects of ac in circuit: Ac with peak value less than full scale affects accuracy less than 2% at frequencies different from the carrier (40 KC) and its harmonics.

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Size: Cabinet mount, 7½" wide, 11½" high, 14¼" deep. Weight 19 pounds. Rack mount, 19" wide, 7" high, 12½" deep. Weight 24 pounds.

Probe Tip Size: Approximately ⅝" x 7/16". Wire aperture diameter 3/16".

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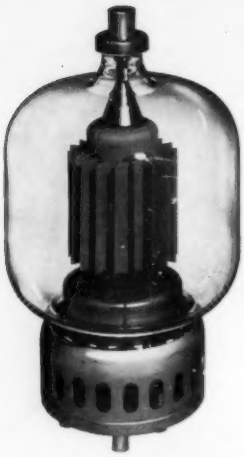

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